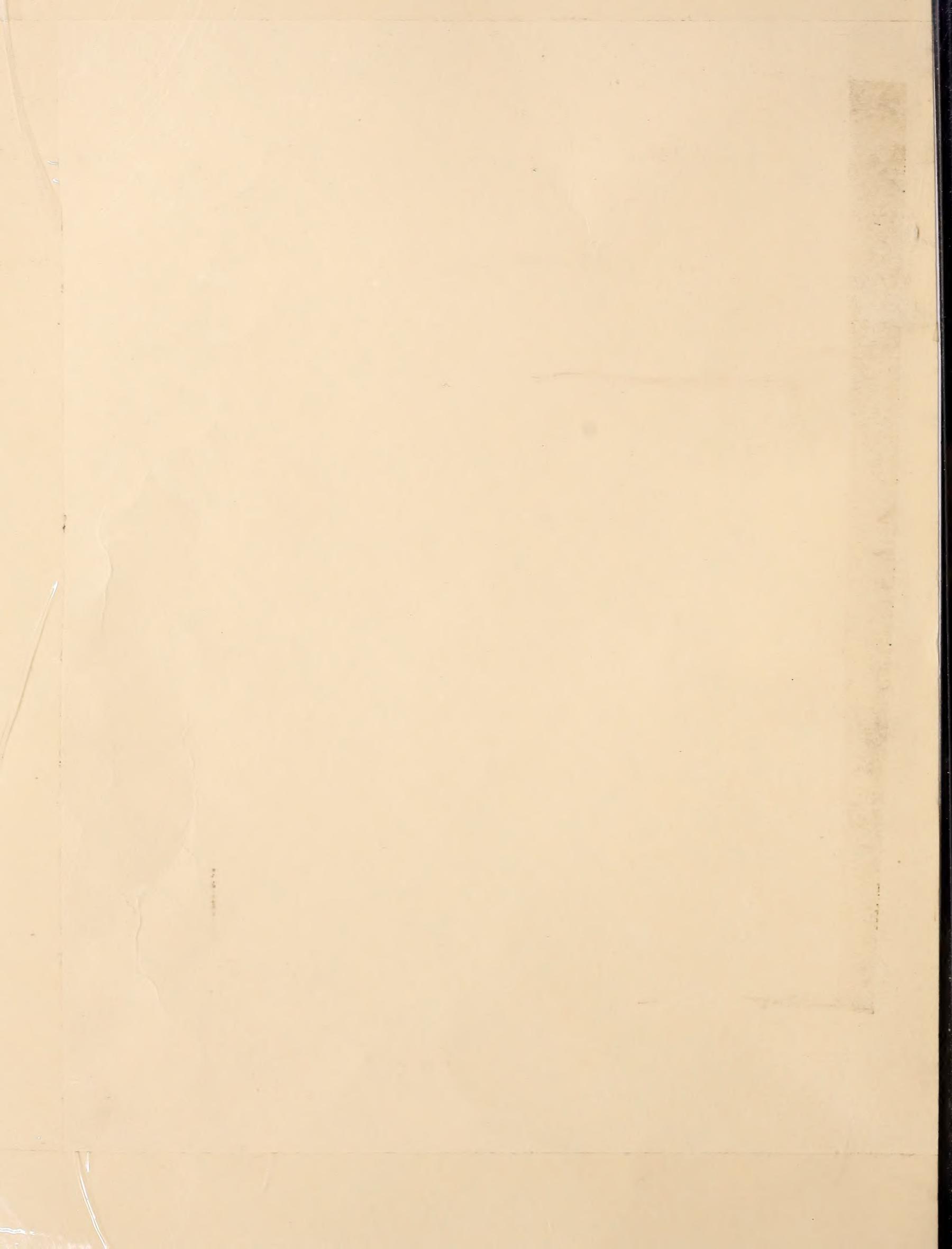


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MANPOWER USE in the

**WOOD-PRODUCTS INDUSTRIES
of OREGON and WASHINGTON**

1950 - 1963

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by Richard C. Smith
and Donald R. Gedney

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE

U. S. FOREST SERVICE
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FOREWORD

This study of employment in the wood-products industries during the period 1950 to 1963 was undertaken in response to the need for a sound, up-to-date basis for projecting the future development of the Pacific Northwest forest economy. This need became particularly apparent when the Bonneville Power Administration undertook its comprehensive study entitled "Pacific Northwest Economic Base Study for Power Markets." In order to develop this information, Bonneville Power Administration contracted with the Station and provided the funds necessary for an appraisal of output and employment in the forest-products industry.

Dr. Richard C. Smith temporarily joined our staff while on sabbatical leave from the University of Missouri forestry staff. This cooperation by the University of Missouri is very much appreciated. Donald R. Gedney is resource analyst in our Forest Survey project.

The Oregon Department of Employment and the Washington Employment Security Department supplied data on employment in the wood-using industries. The Western Wood Products Association, American Plywood Association, and many industrial firms supplied data on volume of wood processed, hours of labor expended, and other useful information. Labor and industry leaders, foresters, and numerous other individuals gave their suggestions and appraisals of trends in the industry which were invaluable in the analysis of the statistical data. All of this cooperation is greatly appreciated.



Philip A. Briegleb, Director
Pacific Northwest Forest and Range
Experiment Station

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SUMMARY

In Oregon and Washington during 1963, 138,900 persons were employed by the wood-using industries. This was more than one-third of all manufacturing employment. During the 14 years from 1950 through 1963, employment in the wood-using industries declined 11 percent. This overall reduction resulted from various changes in the separate industries making up the total. It is the result of a complex of factors including changes in total production, increases in the efficiency of manpower, and changes in kinds of products and in the amount of product refinement. Logging employment decreased by 5,000 workers, or about 18 percent, although the volume of logs harvested increased 14 percent. Sawmill employment decreased 44 percent, or by 32,300 workers; however, lumber production dropped only 2 percent. The decrease of 900 workers employed in miscellaneous wood manufacturing resulted largely from a declining output of mill-work and boxes. A threefold increase in plywood production was accompanied by an increase in employment of 81 percent, or 14,800 persons; in the paper and allied products industries, production doubled but employment increased by only 33 percent, or 6,600.

In 1963, the average number of employees per unit of annual wood input was:

<u>Industry</u>	<u>Number of employees</u>
Logging (per MM bd. ft. ^{1/})	1.41
Sawmills and planing mills (per MM bd. ft. ^{1/})	3.60
Veneer and plywood (per MM bd. ft. ^{1/})	7.31
Paper and allied products, 1962 (per M cords of wood used)	3.48

^{1/} International 1/4-inch rule.

Manpower use, per unit of wood input as shown above, decreased substantially in these industries in the years between 1950 and 1963:

<u>Industry</u>	<u>Percent</u>
Logging	26
Sawmills and planing mills	42
Veneer and plywood	50
Paper and allied products (1962)	36

These reductions in manpower use resulted from plant mechanization--particularly for handling of materials, increased worker skill, and the use of more efficient machinery of greater capacity--and development of a mix of products that is processed with fewer workers.

INTRODUCTION

The wood-products industries comprise a large sector of the manufacturing economy of Oregon and Washington. They employ one-tenth of the entire labor force. In many communities, logging contractors and manufacturers of wood products offer the only source of employment other than retail trade and services. Trade and service businesses prosper because of employment and activity in these industries. Almost 139,000 persons worked for wood-products industries in 1963, more than one-third of the number of employees in all manufacturing. They received \$827 million in wages.

The purpose of this study is to determine current employment in the major wood-products industries in Oregon and Washington, to indicate trends between 1950 and 1963 in total manpower use and in employment per unit input, and to show variation between 1957 and 1961 in monthly employment.

The statistics averaged in this report encompass wide variation in individual plants. Mills differ in number of products manufactured, their sizes and grades, and the extent of finishing or remanufacturing. Firms manufacturing essentially the same products often differ in the kinds of equipment operated and degree of mechanization. At individual plants, worker ability and performance, age and condition of machines, transportation, timber supply, and product specifications may be different than for other manufacturers.

The employment data, upon which the bulk of the statistics is based, include only workers directly employed by wood-using industries and as recorded by the Washington Employment Security Department or the Oregon Department of Employment. No attempt was made to include other less direct employment such as for service to equipment used in wood-products industries.

In addition, a survey was made of randomly selected firms within each industry group to show manpower use by job function. Data were obtained from a mailed questionnaire or by personal interview. Information supplied by individual firms was weighted by volume of wood processed to arrive at average manpower use. The total manpower use for each industry, obtained by this sampling, was found to be in general agreement with that based on published information for all firms by State subarea.

TOTAL EMPLOYMENT IN THE WOOD-PRODUCTS INDUSTRIES

Employment in 1963

In 1963, more than one-half of the manufacturing labor in Oregon was employed by the forest-products industries.^{1/} In Washington, with a more diversified industrial base, one-fourth of the employees in all manufacturing worked in the wood-products industries.

For the two States, 17 percent of the 138,900 employees in the forest-products industries were engaged in supplying logs to mills and plants (table 1). Close to 42,000 persons, 30 percent, worked for sawmill and planing mill firms, and 24 percent worked for veneer and plywood companies. Paper and allied products firms employed 19 percent, and about 10 percent were engaged in miscellaneous wood manufacturing. More than one-half of the workers in miscellaneous wood manufacture and 72 percent of those in paper and allied products were employed in Washington (table 2). In the other major forest-products industries, almost two-thirds of the workers were employed in Oregon, including 73 percent of all veneer and plywood employees.

Table 1.--Average employment in manufacturing and wood-using industries in Oregon and Washington, 1963

Industries	Employees	Percent of wood-using industries	Percent of all manufacturing industries
Wood-using:			
Logging	23,669	17.0	--
Sawmills and planing mills	41,772	30.1	--
Veneer and plywood	33,040	23.8	--
Paper and allied products	26,170	18.8	--
Miscellaneous wood manufacturing	14,274	10.3	--
Total	<u>138,925</u>	<u>100.0</u>	<u>37.6</u>
All other manufacturing	230,395	--	62.4
Total all manufacturing	369,320	--	100.0

^{1/} Statistics were compiled from monthly employment data provided by the Oregon Department of Employment and the Washington Employment Security Department. The nature of data, method of compilation, and definition of industries are described later in the report.

Table 2.--Average employment in wood-using industries in Oregon
and Washington, by State subregion, 1963

Industries	Oregon			Washington		Total
	Western		Eastern	Western	Eastern	
						Number
Logging	11,054	9,503	1	9,514	1,598	23,669
Sawmills and planing mills	18,554	7,407		11,048	4,763	41,772
Veneer and plywood		<u>1/</u> 24,007			<u>1/</u> 9,033	33,040
Paper and allied products, total	<u>1/</u> 7,366	--		17,740	<u>1/</u> 2,311	26,170
Pulp	229					2,540
Paper, paperboard, building paper and building board	<u>1/</u> 5,412	--			<u>1/</u> 13,512	18,924
Paperboard containers and boxes	665		--		<u>1/</u> 1,751	2,416
Other paper and board products	1,060	--			<u>1/</u> 1,230	2,290
Miscellaneous wood manufacturing, total	5,302	1,267			<u>1/</u> 7,705	14,274
Special product sawmills	788	--			2,351	40
Millwork	1,787	<u>1/</u> 904	1,050		2,627	621
Prefabricated structures and parts					612	23
Wooden containers	445	58		408		1,539
Wood preserving		<u>1/</u> 460			<u>1/</u> 408	1,040
Other wood products		<u>1/</u> 1,077		394		868
						1,563

1/ "Eastern" and "western" combined to avoid disclosure of employment by individual firms.

In all wood-using industries combined, 55 percent of the workers were employed in Oregon and 45 percent in Washington; table 2 shows 1963 employment within each State.

Trends in Employment, 1950-63

Employment down 12 percent

Average annual employment in all wood-using industries decreased from 156,000 persons in 1950 to 139,000 in 1963 (fig. 1). Periods of business recession are reflected in low employment during 1954, 1957, and 1958. Peak employment occurred in 1951, 1955, and 1959. Employment in Oregon wood industries was consistently higher than in Washington during this period. The number of workers declined in both States, and the losses occurred at a slightly greater rate in Washington.

Decrease in sawmill employment largest

The largest decrease in employment in the forest-products industries during 1950 to 1963 was in the manufacturing and processing of lumber (fig. 2 and table 3). In 14 years, employment in sawmills and planing mills decreased from 74,000 to 41,800. This decrease took place between 1950 and 1961. Employment stayed at about the same level in 1961, 1962, and 1963.

Plywood, pulp and paper employment up

The veneer and plywood industry recorded a substantial gain of 81 percent between 1950 and 1963. The only other major wood industry increasing was the pulp and paper industry with a more moderate gain of 33 percent. In both of these industries, the gain in employment was relatively steady and constant during the period.

Table 3.--Employment in the major wood-products industries

in Oregon and Washington, 1950 and 1963

Industry	1950	1963	Change
	----- Number -----		Percent
Logging	28,664	23,669	-17
Sawmills and planing mills	74,053	41,772	-44
Veneer and plywood	18,261	33,040	+81
Miscellaneous manufacturing	15,199	14,274	-6
Pulp and paper	19,605	26,170	+33
Total	155,782	138,925	-11

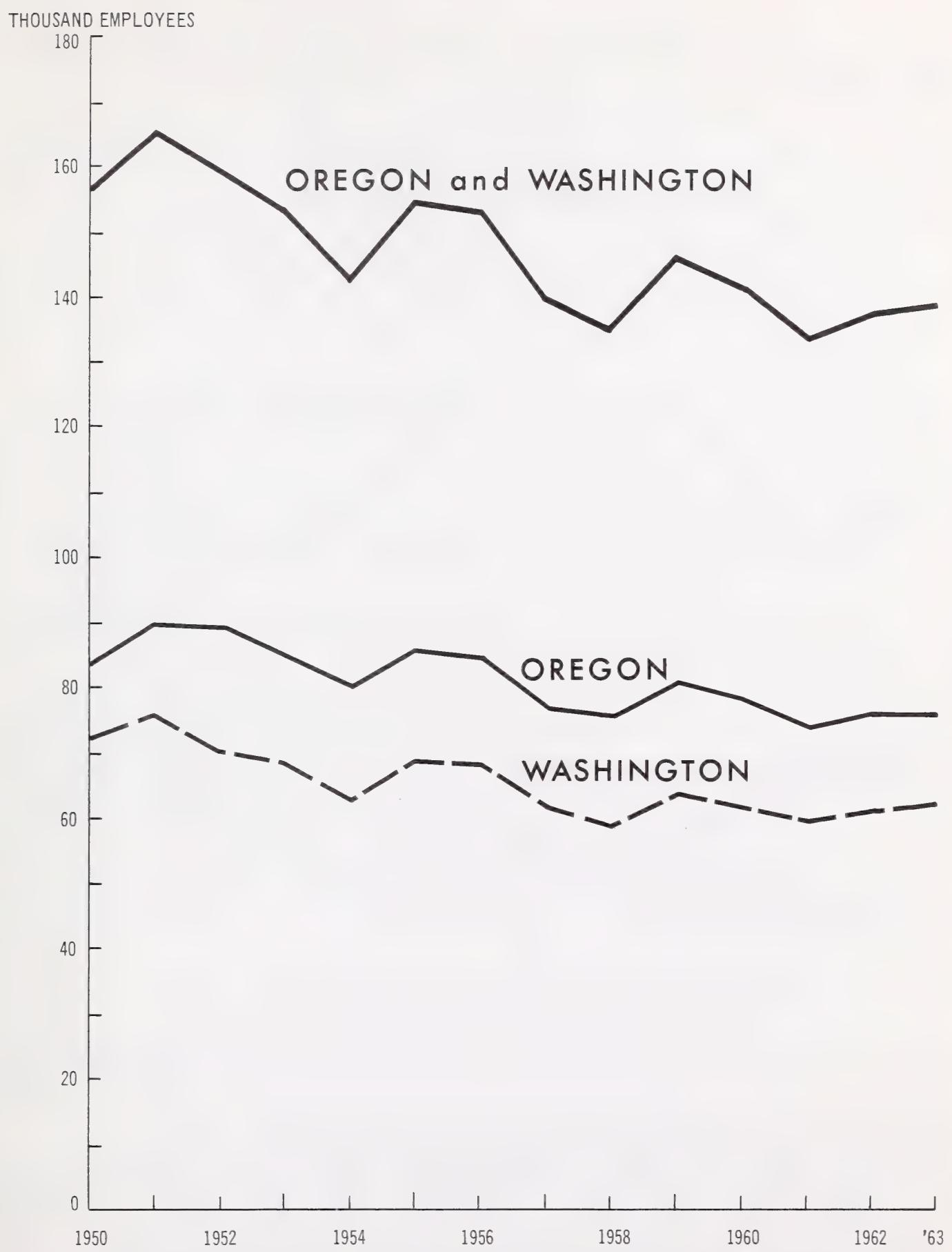


Figure 1.--Average annual employment in all wood-using industries in Oregon and Washington, 1950-63.

THOUSAND EMPLOYEES

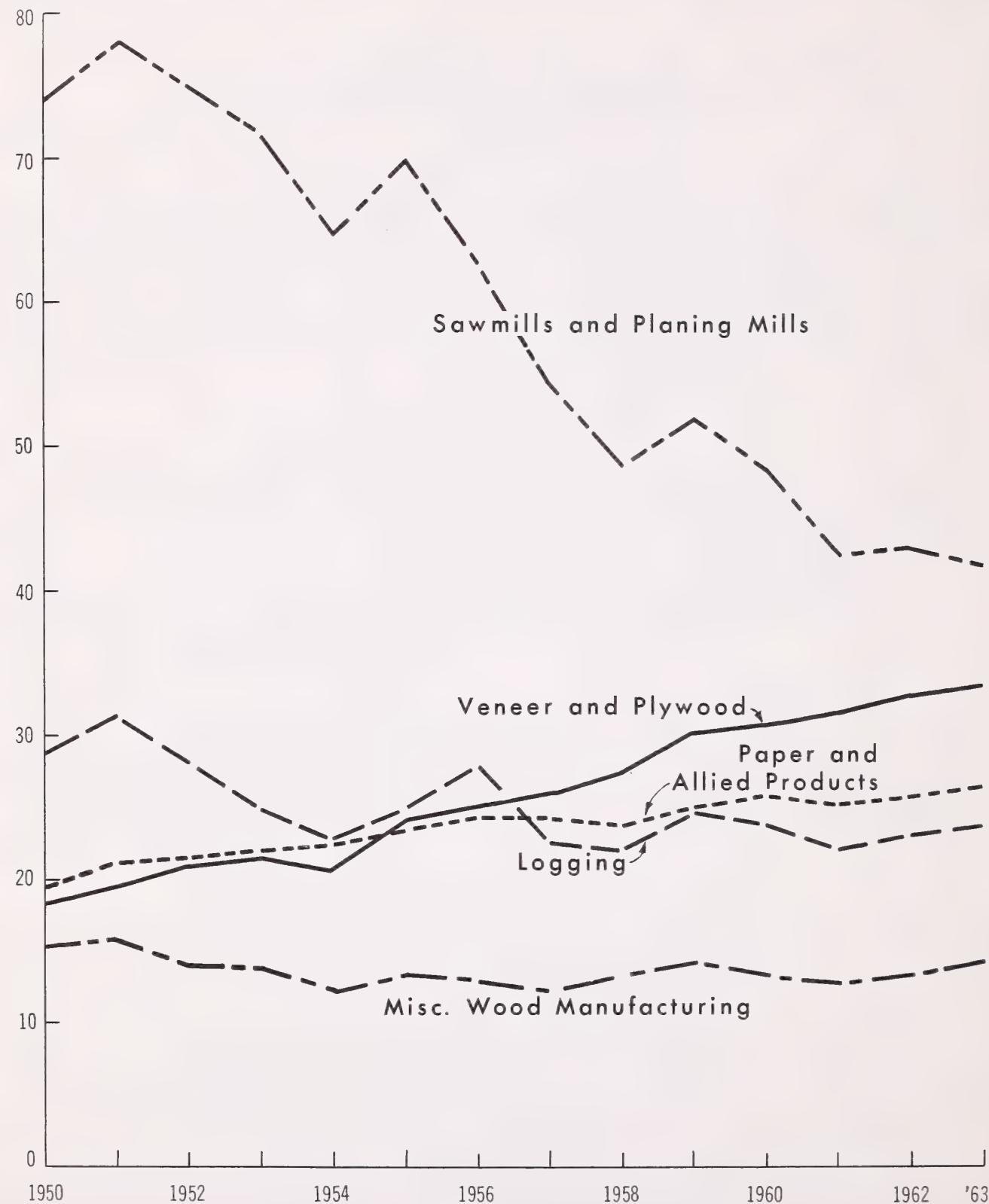


Figure 2.--Average annual employment by wood-using industries in Oregon and Washington, 1950-63.

EMPLOYMENT IN THE LOGGING INDUSTRY

Trends in Annual Employment Down

Employment loss greatest west of the Cascades

Employment in the logging industry in Oregon and Washington decreased from about 29,000 persons in 1950 to 24,000 in 1963. Most of this reduction took place on the west side of the Cascade Range, with the greater loss occurring in western Washington (fig. 3). Although changes in employment were not great east of the Cascades, some decrease in logging employment took place in eastern Oregon but a slight gain was registered in eastern Washington.

A comparison of the log production statistics, shown in the small inset graph in figure 3, with employment shows that production and employment do not always follow the same trend. In western Oregon, both employment and log production decreased; in western Washington, employment dropped although log production stayed relatively level. In eastern Oregon, employment decreased and log production increased, and in eastern Washington, both log production and employment increased.

Annual manpower use in logging decreasing

Average manpower use for logging during the 14 years was different among State subregions (fig. 4). Both western Washington and eastern Washington were higher in manpower use per unit volume logged than the two Oregon subregions. Differences in rate of change were also broadly apparent, with western Oregon showing only relatively moderate decline over time compared with the more pronounced downward trend in other State subregions.

Manpower used for logging in 1963 in western Washington was 1.73 workers per million board feet of logs harvested, 35 percent higher than in western Oregon.

Manpower Use by Job Function

Almost half annual manpower use expended in woods

Almost one-half of the labor effort in logging was actually expended in the woods in the processes of falling, bucking, yarding, and loading (table 4). Hauling and other jobs, including maintenance and shopwork, took another 36 percent. The number of workers was significantly greater on the west side than on the east side for all job functions except hauling, but the percentage distributions of total manpower among the job functions were similar. The manpower use shown in table 4 for road construction and maintenance is undoubtedly too low for constructing a major access road. However, this average figure includes many logging operations that do not require much road work in relation to timber volume harvested.

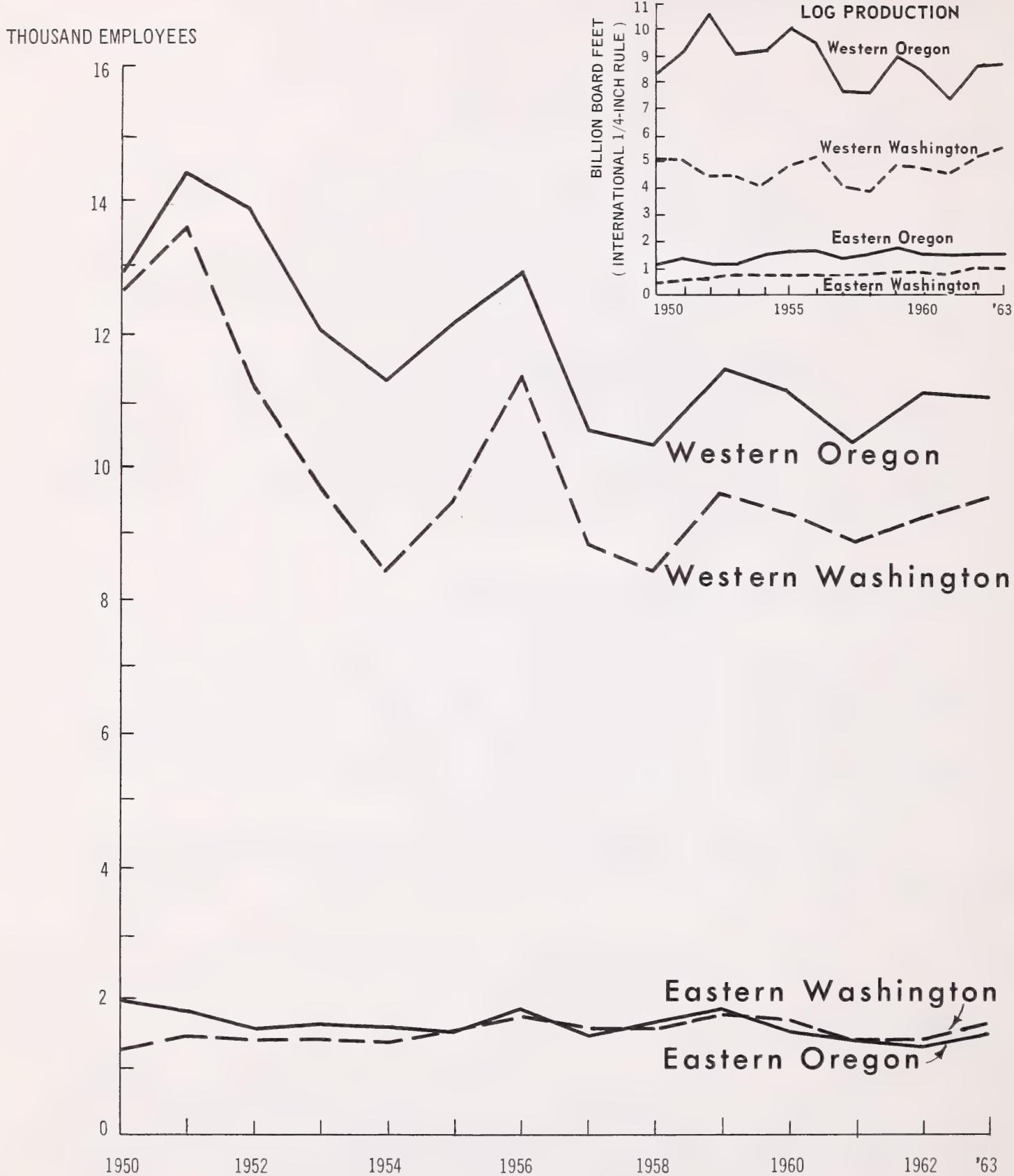


Figure 3.--Average annual employment in logging and log production in Oregon and Washington, by State subregion, 1950-63

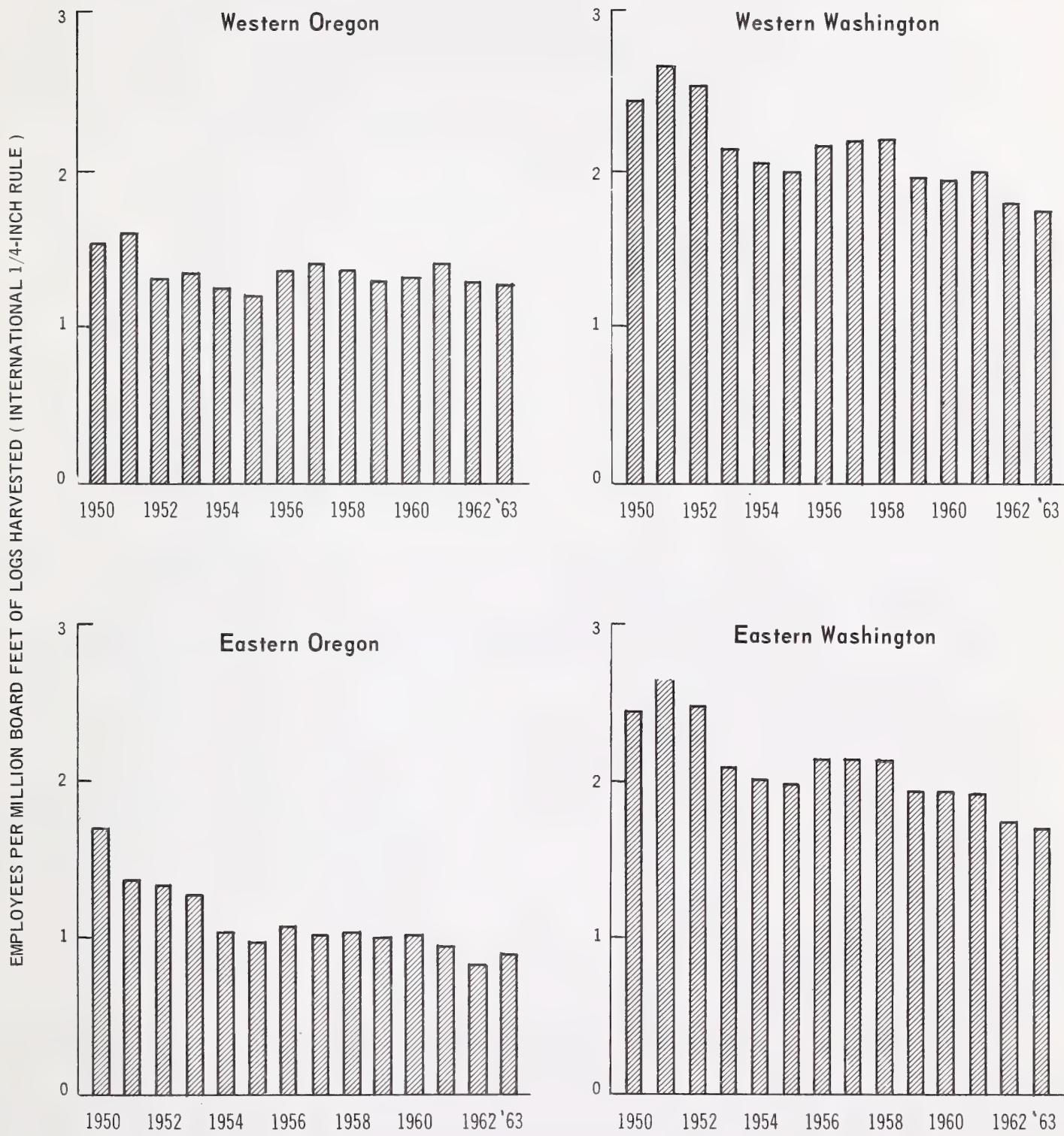


Figure 4.--Average annual employment per million board feet of logs (International 1/4-inch rule) harvested in Oregon and Washington, by State subregion, 1950-63.

Table 4.--Logging manpower use, by job function and number of employees
per million board feet of logs harvested annually in Oregon
and Washington and by subregion, 1962

Job function	West side ^{1/}		East side ^{2/}	
	Number	Percent	Number	Percent
Falling, bucking, yarding, and loading	1.06	47	0.87	48
Road construction and maintenance	.21	9	.14	7
Hauling	.38	17	.46	25
Supervision and clerical	.19	8	.11	6
Other, including maintenance and shop	.43	19	.26	14
Total	2.27	100	1.84	100

Source: Data supplied by 37 firms that harvested 648 million feet of logs, Scribner scale.

^{1/} West of the Cascade Range.

^{2/} East of the Cascade Range.

Output per man-hour by job function

Data supplied by the firms sampled were also compiled to show current average rates of output per man-hour for production workers by job function during 1962 (table 5). Maintenance employees, overhead, and others not directly engaged in the production process were not included by job function but were included in the computation of the overall rate of output per man-hour for all employees on all job functions.

The data shown in table 5 of output of logs per man-hour by job function should not be used as a basis of comparison of differences for specific job functions between the west and the east side. Although part of the differences are real and reflect differing output per man-hour, these are obscured by the

use of local log rules that measure the same volume differently.^{2/} On the east side, the use of a "short log" Scribner rule—^{3/} results in higher volume estimates than if the same log were measured by the "long log" scaling practice common to the west side. Thus, the data shown in this table, and in other presentations in this report showing values for both the east and west side and using log volumes, Scribner scale, as a basis for comparison, do not measure relative efficiencies in worker output between the east and west side. Instead, they simply provide a measure of output in units of production unique to the particular area.

Table 5.--Logging output of logs per man-hour in Oregon and Washington,
by job function and subregion, 1962

Job function	West side ^{1/}	East side ^{2/}
-- <u>Board feet, Scribner rule</u> --		
Falling, bucking, yarding, and loading	483	586
Hauling	1,342	1,095
All employees, all job functions	224	277

Source: Data supplied by 37 logging firms that harvested 648 million feet of logs, Scribner rule.

^{1/} West of Cascade Range.

^{2/} East of Cascade Range.

^{2/} Staebler, George R. Long logs or short logs with the Scribner scale. Timberman 54(10): 66, 68, 70, illus. 1953.

^{3/} In general, where results of industry canvasses or association studies are reported, the log rule used is not converted to the standard Forest Survey unit of measurement of board-foot volume, the 1/4-inch International rule. The Scribner scale is approximately 80 percent of the comparable International 1/4-inch volume on the west side and 91 percent on the east side. In other instances, such as the general figures of production shown in the inset graph in figure 3, the volume is shown in the 1/4-inch International rule.

Logging output per man-hour has increased most in pine region

Logging output, per man-hour of production workers employed by firms reporting to the Western Wood Products Association, is shown in figure 5. An increase per man-hour on west-side operations from 175 feet, Scribner scale, in 1950 to 235 feet in 1962 is substantial, but logging output per man-hour in the pine region increased from 260 feet in 1950 to 470 feet in 1961. Data for the pine region include reports from portions of 12 Western States, a broad heterogeneous area, here referred to as the pine region and used to reflect trends in eastern Oregon and eastern Washington. Data reflecting west-side conditions include some mills in California but represent well the conditions in western Oregon and western Washington.

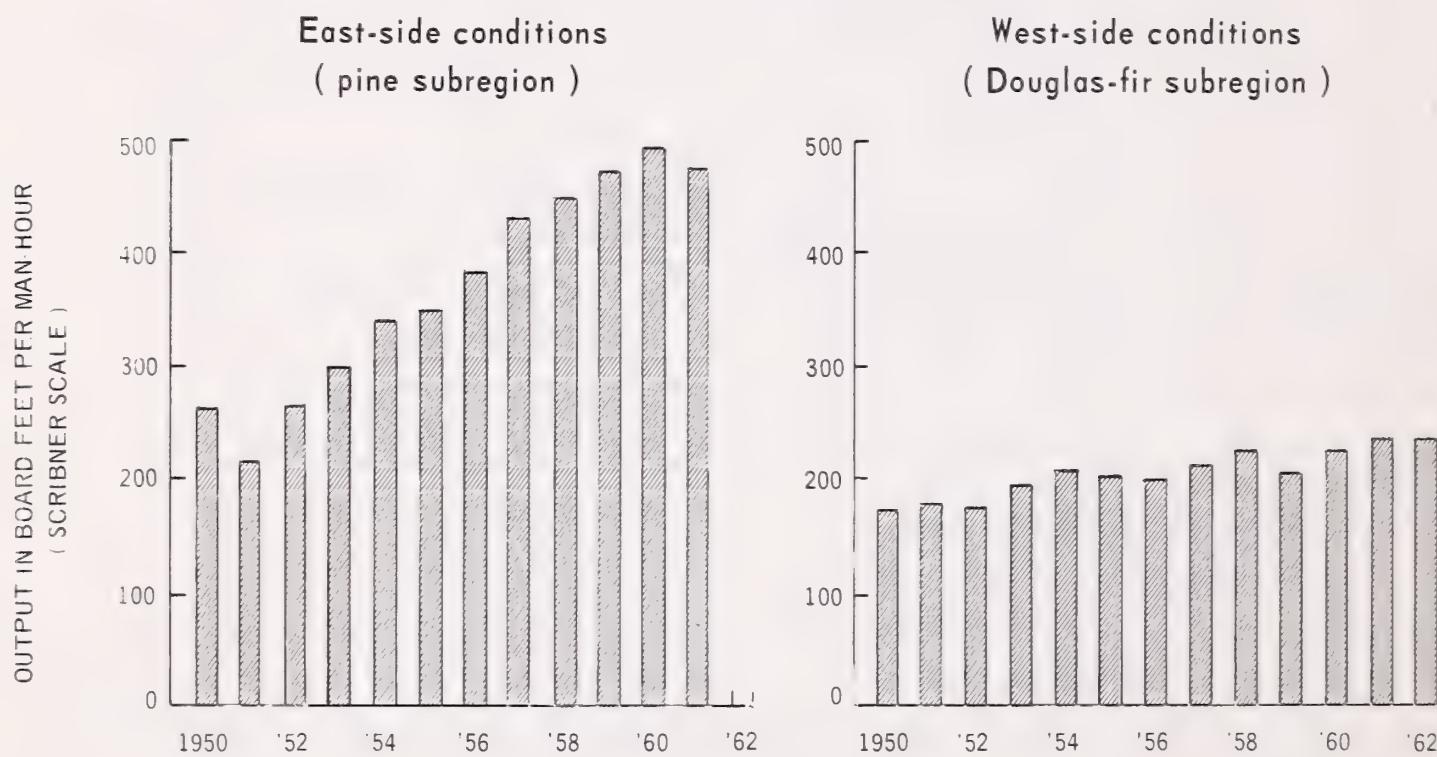


Figure 5--Logging output per man-hour of firms reporting to Western Wood Products Association, by subregion, 1950-62.

The association data differ from those previously shown because they include production workers only. According to the 1958 Census of Manufactures, for the Pacific Northwest the proportion of production workers in logging to all employees was 89 percent. Thus, output per man-hour based on association data is higher than if the ratios were based on all employees.

EMPLOYMENT IN SAWMILLS AND PLANING MILLS

Employment in Sawmills Down 44 Percent

Western Oregon has greatest reduction

Employment statistics by industry groups show where gains and losses occurred (fig. 2). The largest change took place in sawmills and planing mills, a decrease from 74,000 in 1950 to 41,800 in 1963, or 44 percent. Unfavorable years for the lumber industry are reflected in low employment during 1954, 1957, and 1958. The decrease in employment was much greater than the decrease in lumber production, which was 2 percent during the same period, from 11.8 billion board feet in 1950 to 11.6 billion in 1963 (fig. 6). Two-thirds of the reduction in sawmill and planing mill employment occurred in western Oregon, where the number of workers decreased from 39,000 to 18,600. Western Washington sawmill employment dropped somewhat less, from 20,000 to 11,000. In eastern Oregon, the decrease was from 10,500 to 7,400; however, in eastern Washington little change occurred. All of these changes are not directly associated with changes in local production. This can be seen by comparing the production data in the inset graph of figure 6 with the employment data. For example, western Oregon 1963 employment was 48 percent of that in 1950, but 1963 lumber production was 89 percent of that in 1950. Similarly, western Washington 1963 employment was 55 percent of that in 1950, but lumber production was 84 percent of 1950 output. Although lumber production increased in eastern Oregon and eastern Washington, employment did not.

Sawmill manpower use per unit input requires fewer employees

Manpower use, by all of the sawmills and planing mills, decreased from approximately 6.2 employees per million board feet of logs^{4/} used in 1950 to about 3.6 workers in 1963. Despite relatively wide annual fluctuations in employment per million board feet of logs used, a reduction in manpower use occurred in all subregions (fig. 7). For the industry as a whole, manpower use per unit of wood used was reduced 42 percent in the past 14 years.

Manpower use in Oregon plants generally lower

In 1963, sawmills and planing mills in western Washington used 37 percent more labor per unit input than mills in western Oregon. East of the Cascade Range in the two States, the sawmill manpower needs are more nearly alike. However, Washington sawmill employment per unit on both sides of the Cascades is higher than in Oregon.

^{4/} International 1/4-inch rule. Log scale and lumber grade are assumed to be equal.

THOUSAND EMPLOYEES

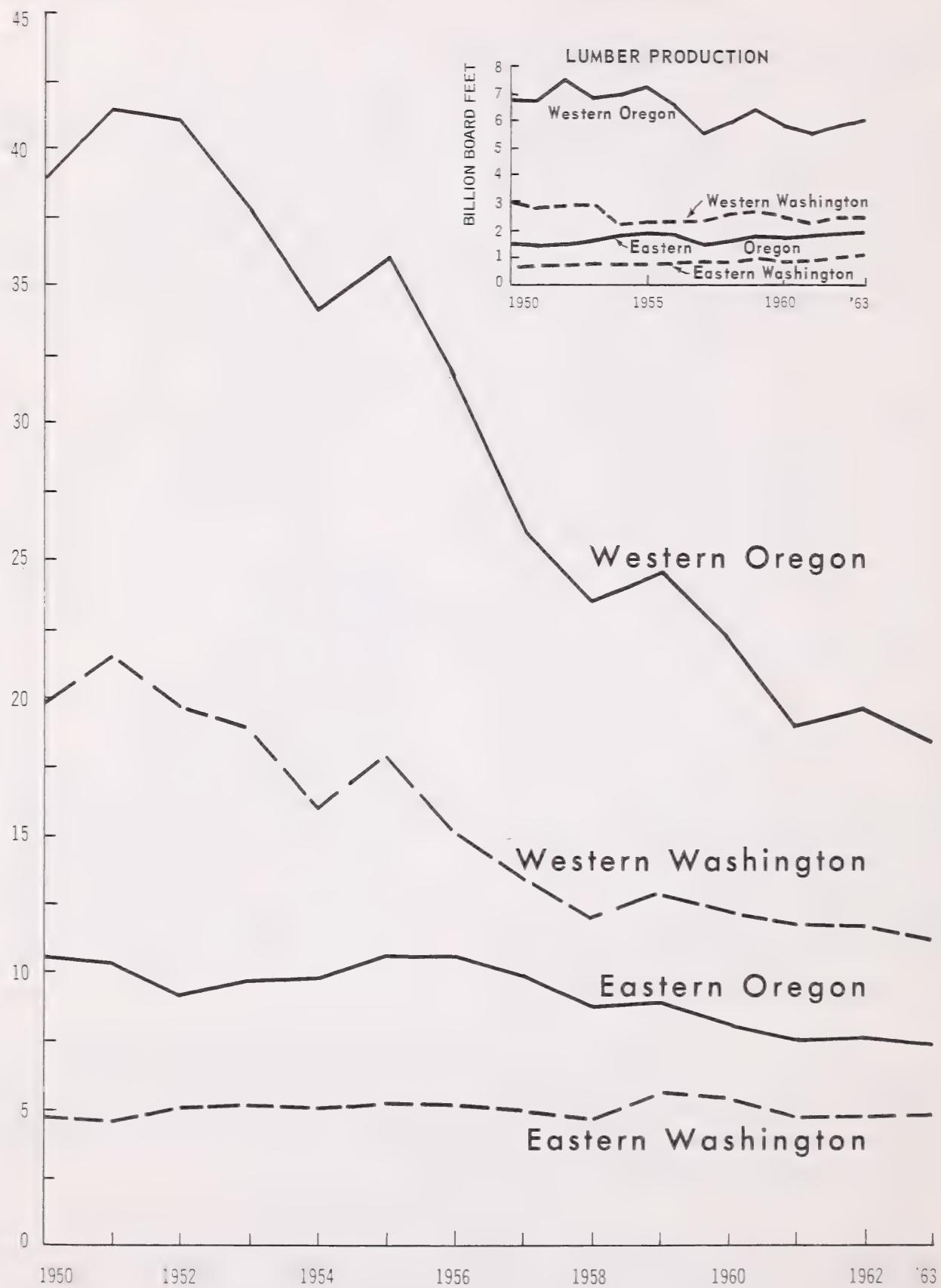


Figure 6--Average annual employment and lumber production in sawmills and planing mills in Oregon and Washington, by State subregion, 1950-63.

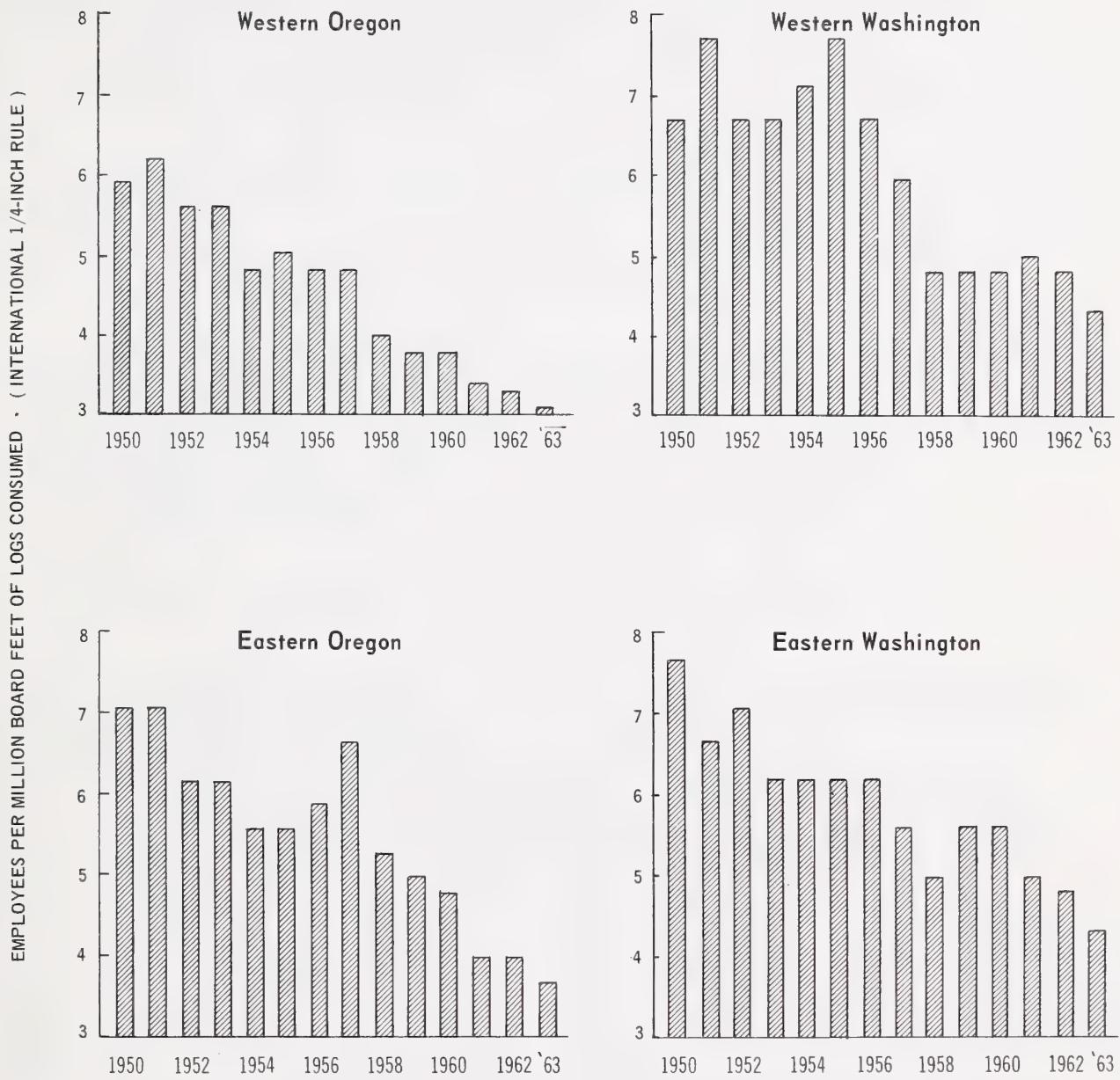


Figure 7.--Average annual employment in sawmills and planing mills per million board feet of logs consumed in Oregon and Washington, by State subregion, 1950-63.

Manpower Use by Job Function

Million board feet of lumber produced annually by three to four employees

In the sawmill and planing mill group, about 40 percent of the manpower use was in the sawmill operation, from pond to green chain, for the three major size classes (table 6). Class A mills (8-hour capacity, 120,000+ feet board measure) required 1.22 man-years per million feet of lumber output; class B (8-hour capacity, 80,000 to 119,000 feet), 1.46 man-years; and class C mills (8-hour capacity, 40,000 to 79,000 feet), 1.70 man-years per million feet. The larger mills probably used less labor because of more complete mechanization and faster operating speeds.

Table 6.--Man-years of employment in sawmills and planing mills per
million board feet of lumber output, by job function and
mill-size classes, in Oregon and Washington, 1962

Job function	Mill-size class ^{1/}					
	A (120+)	B (80-119)	C (40-79)			
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Sawmill operation ^{2/}	1.22	38	1.46	45	1.70	42
Kiln-drying	.33	10	.37	11	.23	6
Planing mill	.66	20	.53	16	.87	22
Yards, sheds ^{3/}	.54	16	.44	14	.61	15
Other employees ^{4/}	.52	16	.47	14	.60	15
Total, dry surfaced lumber	3.27	100	3.27	100	4.01	100
Remanufacturing, other processing	7.89		8.86		8.28	

Source: Data supplied by 56 firms that produced 2,294 million board feet of lumber.

^{1/} Thousand-board-foot capacity per 8 hours.

^{2/} Pond through sawmill and green chain.

^{3/} Includes shipping, yard transportation, fire protection, and power plant.

^{4/} Primarily supervision, office, and unassigned maintenance.

The manpower use for kiln-drying differed for mills of different size classes but required only a small amount of labor in any mill, one-third of a man-year per million feet of lumber dried. Other job functions required approximately the same proportion of the total labor requirement in each mill-size class.

Total manpower for manufacturing dry surfaced lumber was 3.27 man-years per million feet for both A and B mills. In C mills, 4.01 man-years per million feet were used. Statistics for the smaller D mills (8-hour capacity, up to 39,000 feet) are not given because of wide variation among firms observed.

Remanufacturing and further processing, other than drying and planing, converts lumber into various kinds of cut stock and finished products and thereby adds about eight men per million feet of annual output--more than twice the labor needed for making dry, surfaced lumber.

Average manpower used for the sawmill operation (pond through sawmill and green chain) was generally lower in east-side mills than in west-side mills (table 7). Although the difference was very slight between B mills, differences of 0.26 man in A mills and 0.21 man in C mills for west side versus east side are apparently significant.

Table 7.--Sawmill manpower use, in employees per million board feet of annual lumber output, by selected mill-size class in Oregon and Washington and by subregion, 1962

Mill-size class ^{1/}	West side ^{2/}	East side ^{3/}
<u>Number of employees</u>		
A (120+)	1.28	1.02
B (80-119)	1.47	1.44
C (40-79)	1.83	1.62

Source: Data supplied by 56 firms that produced 2,294 million board feet of lumber.

^{1/} Thousand-board-foot capacity per 8 hours.

^{2/} West of Cascade Range.

^{3/} East of Cascade Range.

Output per man-hour

Average output of lumber per man-hour in sawmills and planing mills by mill-size class is shown in table 8. In the sawmill operation, output per man-hour was greater in large mills. The high kiln-drying output per man-hour is due to the small amount of labor involved--time, heat, and machinery do the work. Output per man-hour of all employees was 156 and 151 board feet in A and B mills, respectively, and was 128 board feet in C mills.

Sawmilling output per man-hour has increased steadily

Trends in output per man-hour for sawmills and planing mill firms that reported to the Western Wood Products Association are essentially parallel (fig. 8). West-side mills increased from 115 board feet per man-hour in 1950 to 145 board feet in 1962. Output per man-hour in mills on the east side averaged about 10 board feet per man-hour less during the same period.

Table 8.--Output of lumber per man-hour by operation, for sawmills
and planing mills in Oregon and Washington, 1962

Operation	Mill-size class ^{1/}		
	A (120+)	B (80-119)	C (40-79)
----- <u>Board feet</u> -----			
Sawmill ^{2/}	417	350	300
Kiln-drying	1,558	1,367	2,209
Planing	743	961	588
Yards and sheds ^{3/}	952	1,158	833
All processes ^{4/}	156	151	128
Remanufacturing, other processing	65	58	62

Source: Data supplied by 56 firms that produced 2,294 million board feet of lumber.

^{1/} Thousand-board-foot capacity per 8 hours.

^{2/} Pond through sawmill and green chain.

^{3/} Includes shipping, yard transportation, fire protection, and power plant.

^{4/} Weighted average, including supervision, office, and unassigned maintenance.

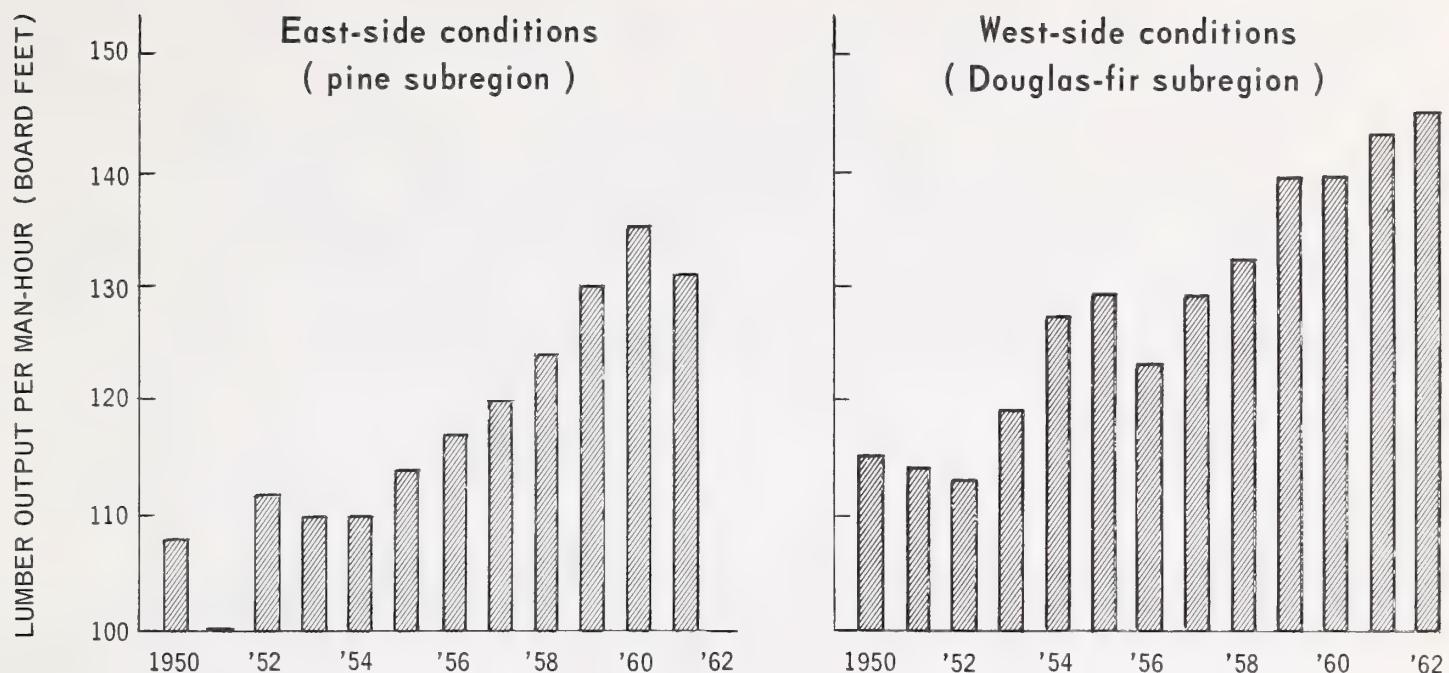


Figure 8.--Average lumber output per man-hour in sawmills and planing mills reporting to Western Wood Products Association, by subregion, 1950-62.

In the Pacific Northwest, the proportion of sawmill production workers to all sawmill employees was 90 percent in 1958.^{5/} Thus, these output data are higher than if all employees were included.

EMPLOYMENT IN THE VENEER AND PLYWOOD INDUSTRY

Plywood Employment Up 75 Percent

Oregon gain greatest

Veneer and plywood employment increased by 80 percent, from 18,300 workers in 1950 to 33,000 in 1963 (fig. 2). Oregon plywood employment increased sharply and steadily from 7,000 to 24,000 but, in Washington, employment dropped from 11,300 to 9,000 (fig. 9). Plywood production increased at a much greater rate^{6/} than employment, going from 2.4 billion square feet,

^{5/} U.S. Bureau of the Census. 1958 census of manufactures. 1961.

^{6/} Production data in Oregon from U.S. Bureau of Census, "Current Industrial Reports, Softwood Plywood and Veneer, 1959-1962," and "Census Facts for Industry, Softwood Plywood and Veneer, 1953, 1955-58, Softwood Plywood 1950-53." For Washington, American Plywood Association figures were used because Census data include Idaho and Montana with Washington production.

THOUSAND EMPLOYEES

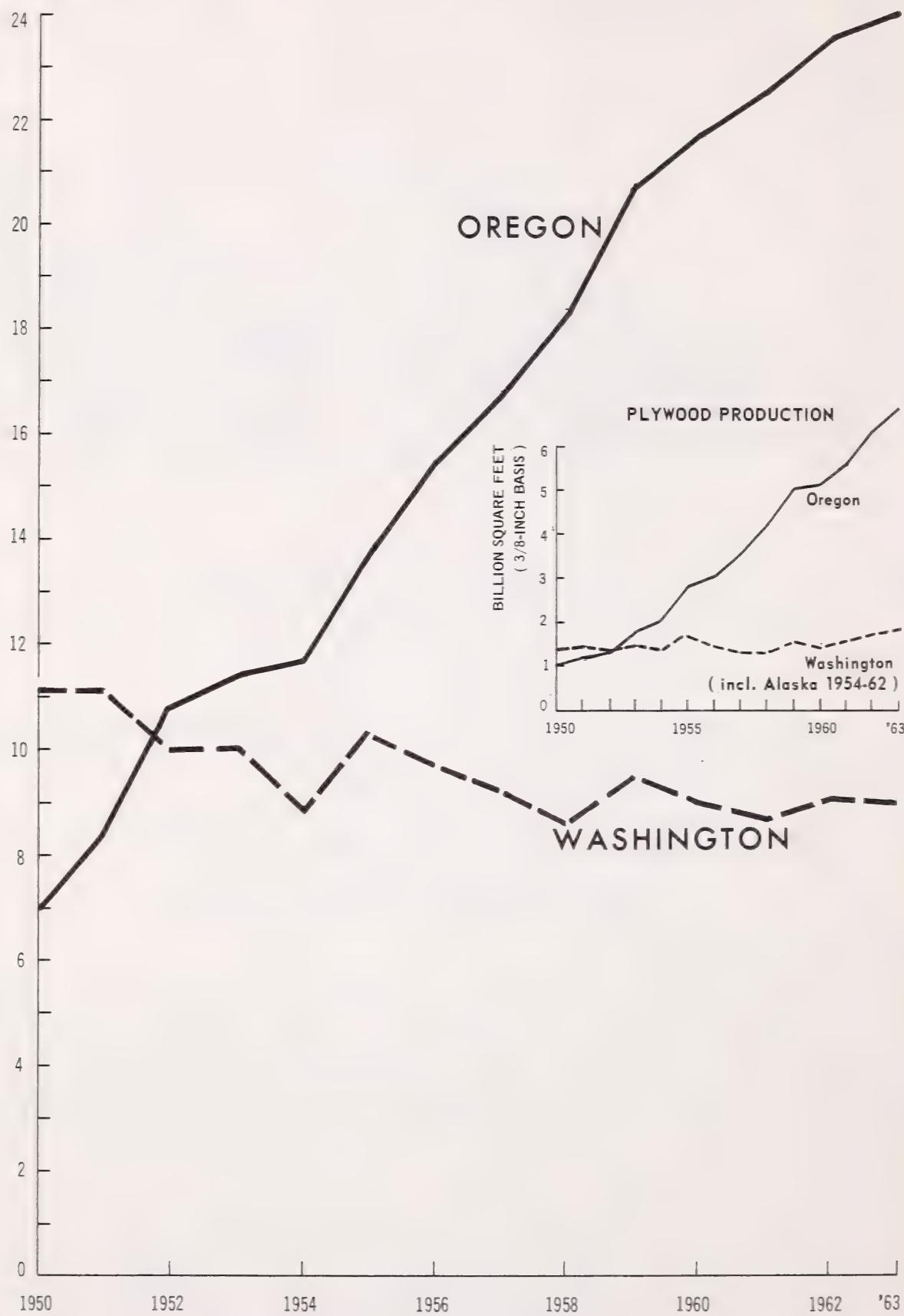


Figure 9.--Average annual employment and plywood production in veneer and plywood plants in Oregon and Washington, 1950-63.

3/8-inch rough basis, in 1950 to 8.6 billion square feet in 1963, an increase of 260 percent. In 1950, slightly more than 1 billion square feet of plywood were produced in Oregon and 1.3 billion in Washington. Mill capacity expanded rapidly in western Oregon, and by 1963, Oregon mills produced 6.8 billion square feet, and Washington had increased production slightly to 1.8 billion square feet. During this 14-year period, veneer and plywood employment in Oregon increased 240 percent but production increased by 530 percent; in Washington, employment dropped 20 percent although production increased 36 percent. Primarily, these changes reflect the movement of the plywood industries south from Washington and their rapid expansion in southwestern Oregon.

Manpower use in veneer and plywood
plants down sharply

Veneer and plywood plants use approximately twice as much labor per unit of wood input as sawmills. Washington plants employed 16.7 workers per million board feet of logs used annually in 1950; by 1963, the manpower needs per million feet of logs used had dropped sharply to 9.8 workers (fig. 10).

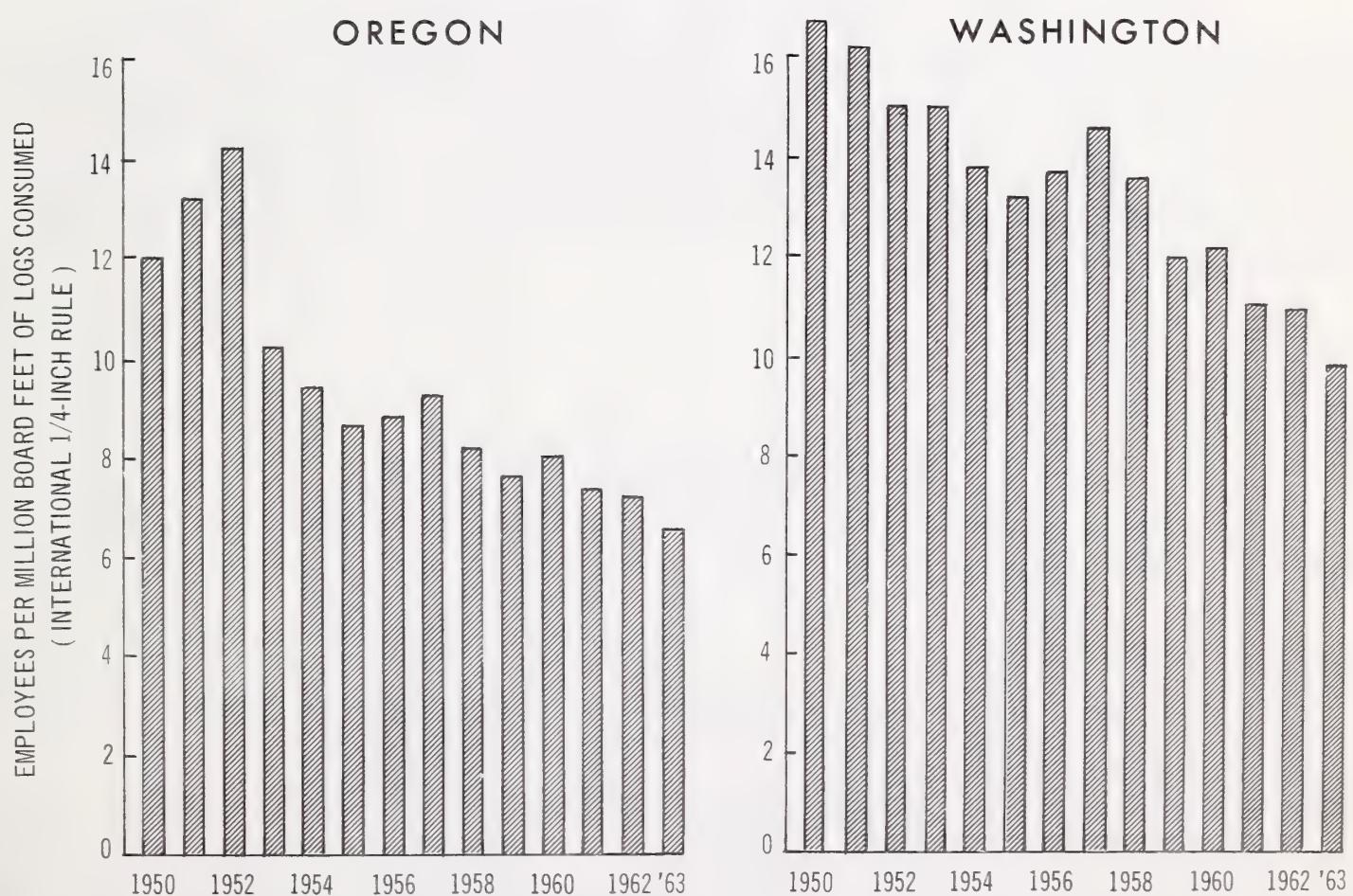


Figure 10.--Average annual employment per million board feet of logs consumed in veneer and plywood plants in Oregon and Washington, 1950-63.

Oregon veneer and plywood firms required 12.0 workers in 1950; by 1963 only 6.7 employees were needed.

Plywood output increasing at rate of 10
square feet per man-hour per year

Information supplied by the American Plywood Association was used to determine trends in output per man-hour in plywood plants. Data, reported to the association each month by plywood firms, were averaged for the years 1955 to 1962 and were weighted by quantity produced. Only firms that produced all veneer needed and sold none were included. The proportion of total production in sheathing varied among individual plants, but the average proportion in all plants sampled in a single year was between 26 and 40 percent and averaged 35 percent. A straight line fitted to annual averages (fig. 11) indicates that output per man-hour increased from 96 square feet, 3/8-inch rough, in 1955 to 166 square feet in 1962. The average annual increase was 10.07 square feet per man-hour. These rates are based on production workers only. According to the 1958 Census of Manufactures, this includes only 92 percent of all employees. Thus, the rates are higher than if the ratios included all employees.

The proportion of sheathing in total output influenced production rates markedly in selected years (fig. 12). In plants that produced sheathing exclusively, output per man-hour in 1956 was 50 percent greater than in plants that produced all sanded grades of plywood; in 1959 it was 32 percent greater. By 1962, significant changes in the rate of production of sheathing had taken place--output per man-hour was 228 square feet, or 69 percent more than in plants that produced no sheathing.

Manpower Use by Job Function

Output of veneer and plywood per man-hour during 1962 in 11 plants was:

<u>Job function</u>	<u>Square feet, 3/8-inch rough basis</u>
Veneer	815
Plywood (layup, etc.)	226
Integrated plant employees (all)	151

Plywood manufacture, with more employees handling each sheet, has a low output per man-hour compared with veneer. In an integrated plywood plant, production per man-hour, including nonproduction employees, drops to 151 square feet.

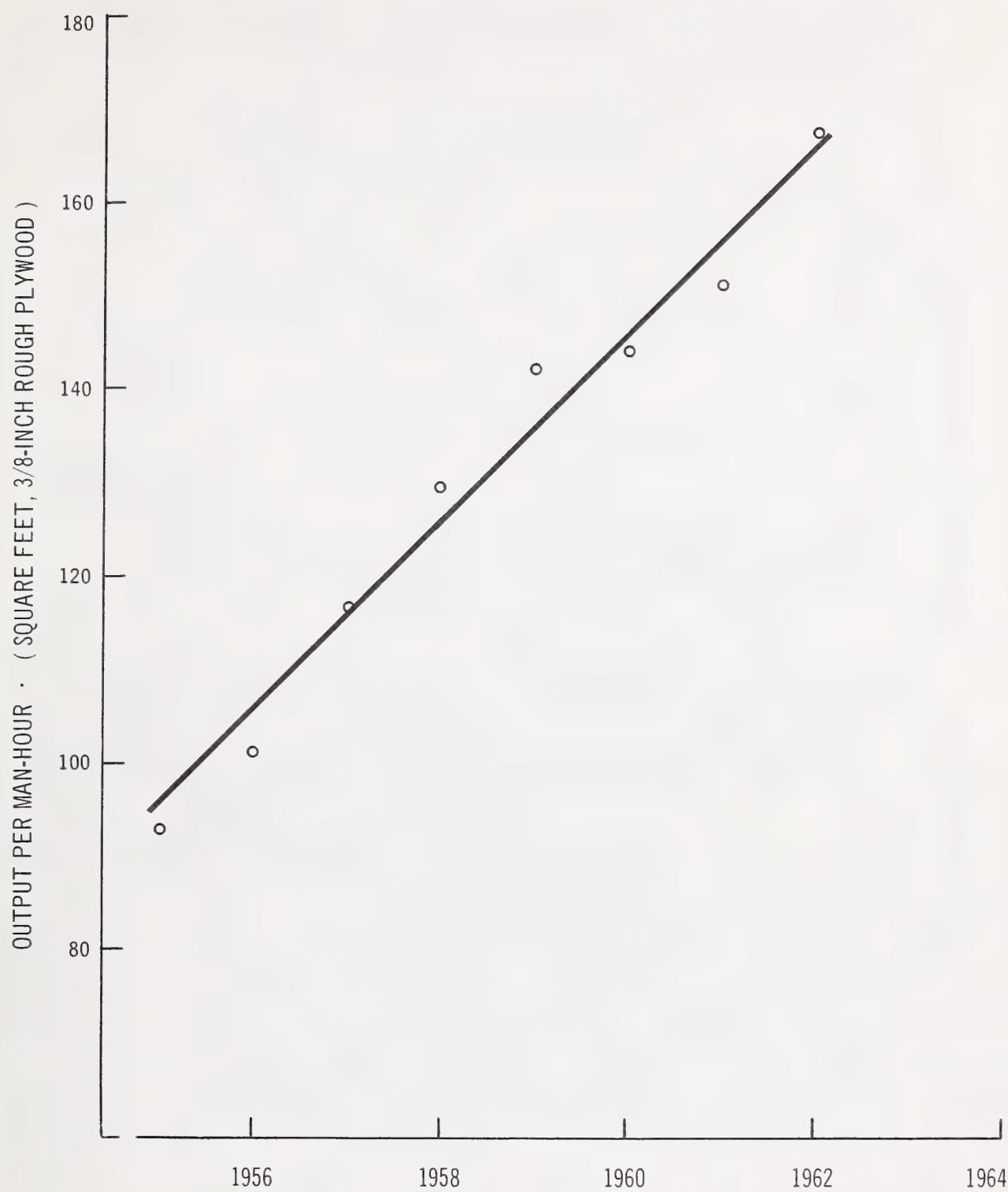


Figure 11.--Output of plywood per man-hour of plants that produced all veneer needed and sold none, as reported to American Plywood Association, 1955-62.

In integrated plywood plants that peel green veneer and also manufacture their own plywood from this green veneer, almost two-thirds of the employees were engaged in some phase of plywood manufacture--laying-up, pressing, trimming, patching, and sanding (table 9). Only 21 percent of the workers were engaged in peeling and drying veneer. In the plants sampled, one-third of the output was sheathing.

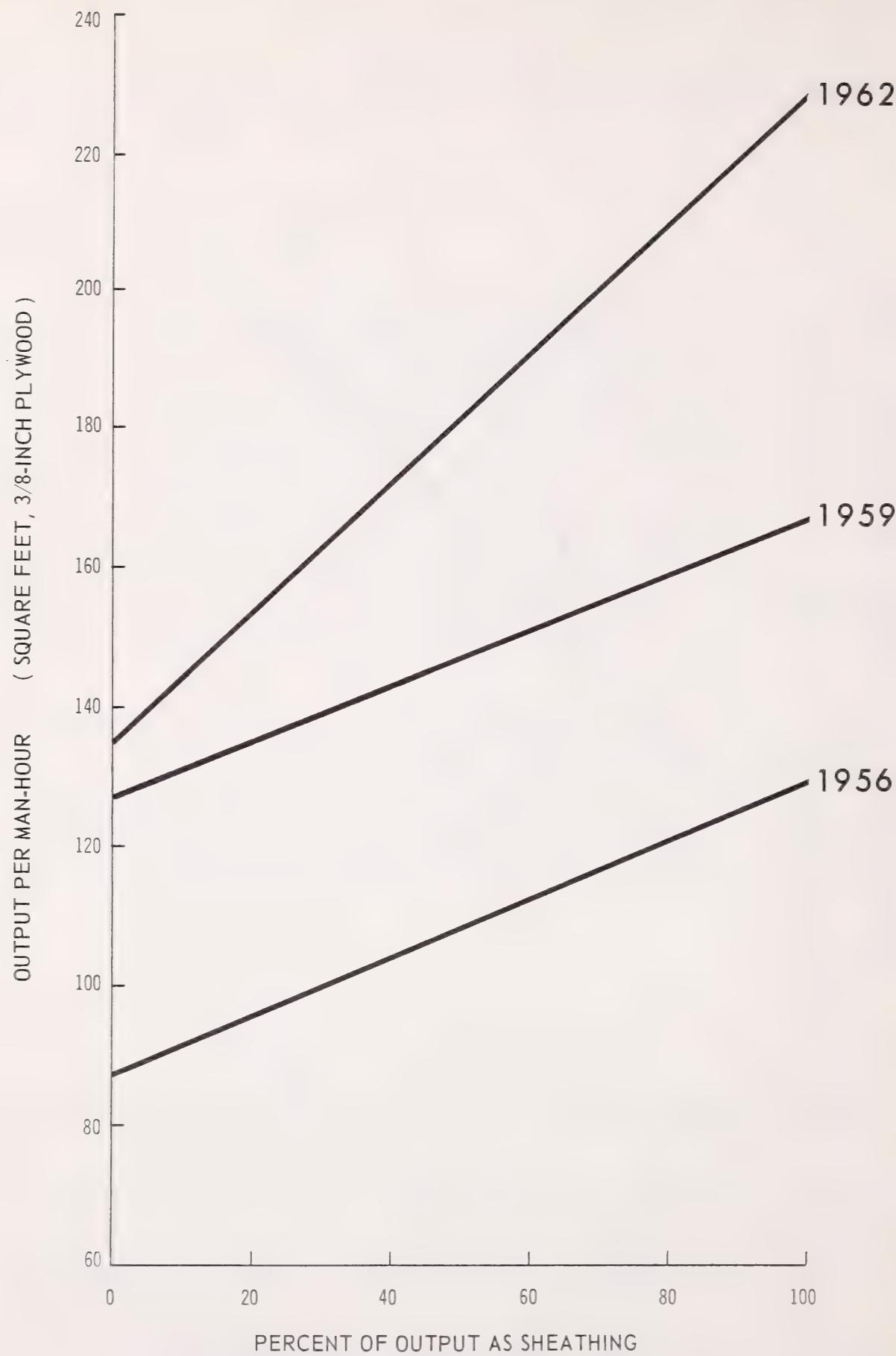


Figure 12.--Output of plywood per man-hour for selected years, by percent of total output in unsanded sheathing; plants that produced all veneer needed and sold none, as reported by the American Plywood Association.

Table 9.--Plywood plant manpower use by job function; number of employees per million feet of logs used annually in Oregon and Washington, 1962

Job function	Number of employees	Percent
Veneer	1.71	21
Plywood	5.21	65
Other	1.17	14
Total	8.09	100

Source: Data supplied by 11 plants that produced 518 million square feet of plywood, rough 3/8-inch basis.

EMPLOYMENT IN THE PULP AND PAPER INDUSTRY

Employment Trend Shows Steady Gain

Pulp and paper workers up 34 percent in 14 years

Employment in paper and allied products increased about 34 percent from 19,600 in 1950 to 26,200 persons in 1963 (fig. 2). Oregon increased its number of pulp and paper workers from 5,500 to 7,400 by the addition of new plants and by expansion of existing ones. Meanwhile, 4,700 workers were added in Washington to bring its total employment to 18,800 persons in 1963 (fig. 13). During this period (1962 was the last year the production data were available) pulp output increased steadily in both States from 2.4 million tons to 4.6 million and Washington pulpmills^{7/} consistently produced about 75 percent of this pulp.

Mills manufacturing paper, paperboard, and building paper show largest gain

Figure 14 shows that the largest part of the increase in employment in paper and allied products took place in mills that manufacture paper, paperboard, and building paper. Increased paper output is primarily responsible, but part of

^{7/} Based on census data. Production figures for Washington include Alaska since 1954.

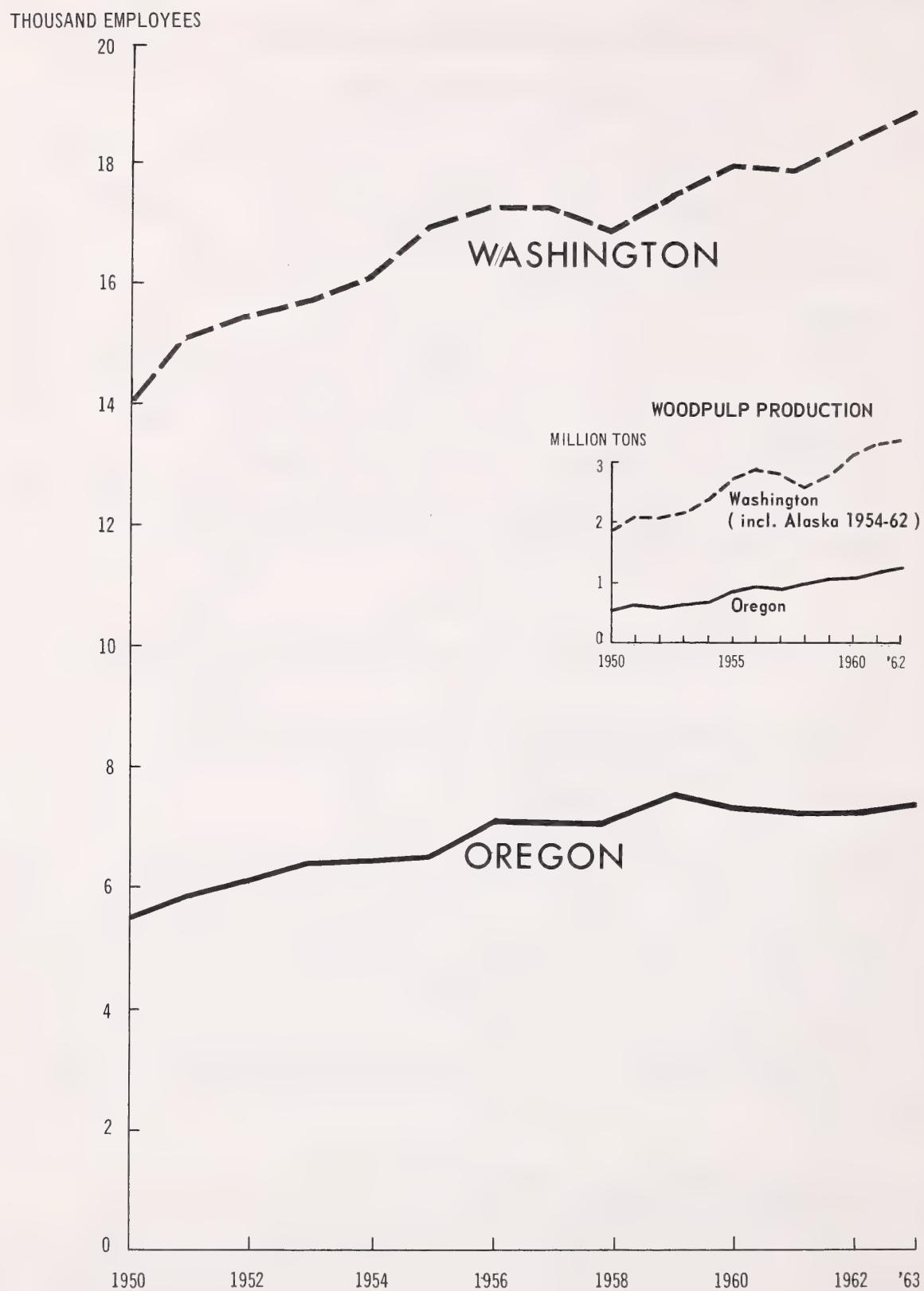


Figure 13.--Average annual employment and woodpulp production in the paper and allied products industries in Oregon and Washington, 1950-63.

Pulp mills



Paper, Paperboard and Building Paper Mills



Converted paper and paperboard products other than containers and boxes



Paperboard containers and boxes

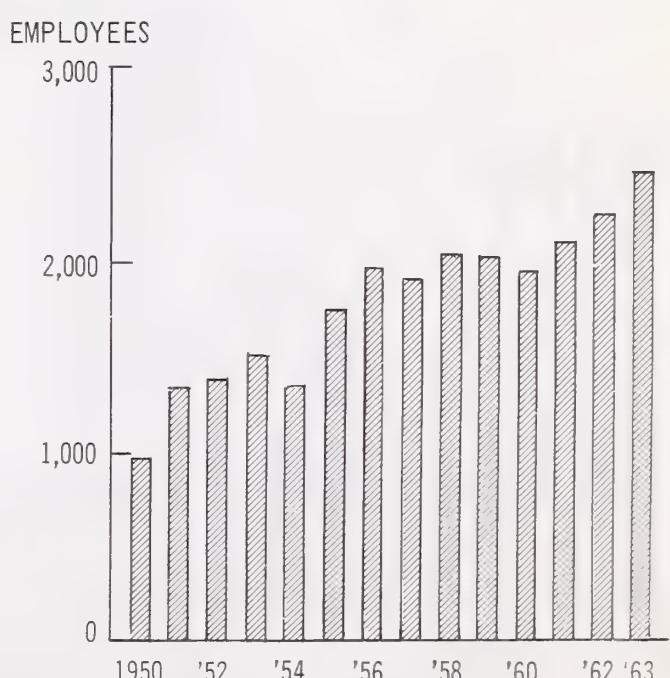


Figure 14.--Average annual employment in the component industries of the pulp and paper industry in Oregon and Washington, 1950-63.

the increase may be due to the way the employment statistics are reported, as this industry classification includes some pulpmills combined with papermills and not separately reported.

A look at the composition of employment in the total paper and allied products field shows that almost 19,000 out of the total 26,200 employees in 1963 were working in the manufacture of paper, paperboard, and building paper (fig. 14). This is also the group showing the greatest increase in number of employees from 1950 to 1963. The number of workers in the other industries have all increased substantially, ranging from 24 percent gains in pulpmills to 156 percent in the manufacture of paperboard containers and boxes. Some caution is needed in interpreting figure 14 because the employment statistics for some mills producing paper and allied products, including pulp, do not differentiate as to exact nature of employment.

A compilation of capacity for pulp and papermaking in 1950 and 1962 (table 10) shows that pulp capacity doubled in both Oregon and in Washington. Paper capacity doubled in Washington and almost tripled in Oregon. Pulp capacity in Washington remained at 1.7 times that of paper. In Oregon, a 1950 pulp capacity of 1.3 times that of paper declined to 1.0 by 1962. Currently, pulp produced in Oregon is largely made into paper by mills within the State.

Table 10.--Production capacity of pulpmills and papermills

in Oregon and Washington, 1950 and 1962^{1/}

Product	Capacity, 24 hours		
	1950	1962	Increase
<u>Percent</u>			
Oregon:			
Pulp (in tons)	1,836.00	3,796.00	107
Paper (in tons)	1,380.00	3,638.00	164
Ratio, pulp to paper	1.33	1.04	--
Washington:			
Pulp (in tons)	5,078.00	9,819.00	93
Paper (in tons)	2,877.00	5,725.00	99
Ratio, pulp to paper	1.76	1.72	--

^{1/} Lockwood's Directory of the Paper and Allied Trades, 75th and 87th editions.

Employment in industries that convert paper into paperboard containers and boxes and in industries that convert paper and paperboard products into other products more than doubled in 14 years (fig. 14). Most of the increase took place prior to 1956.^{8/} These two classifications in the Standard Industrial Classification Manual— include all firms that buy paper and board for conversion into products, but do not include employees engaged in converting products at pulpmills and papermills.

Pulp and paper manpower use per cord
declined more in Oregon

Annual manpower use in the pulp and paper industry in Oregon and Washington decreased during 1950-62 from 5.5 employees per thousand cords per year to 3.5. The decline in Oregon was steady, going from 7.8 employees per thousand cords in 1950 to 3.8 in 1962 (fig. 15). In Washington, a generally

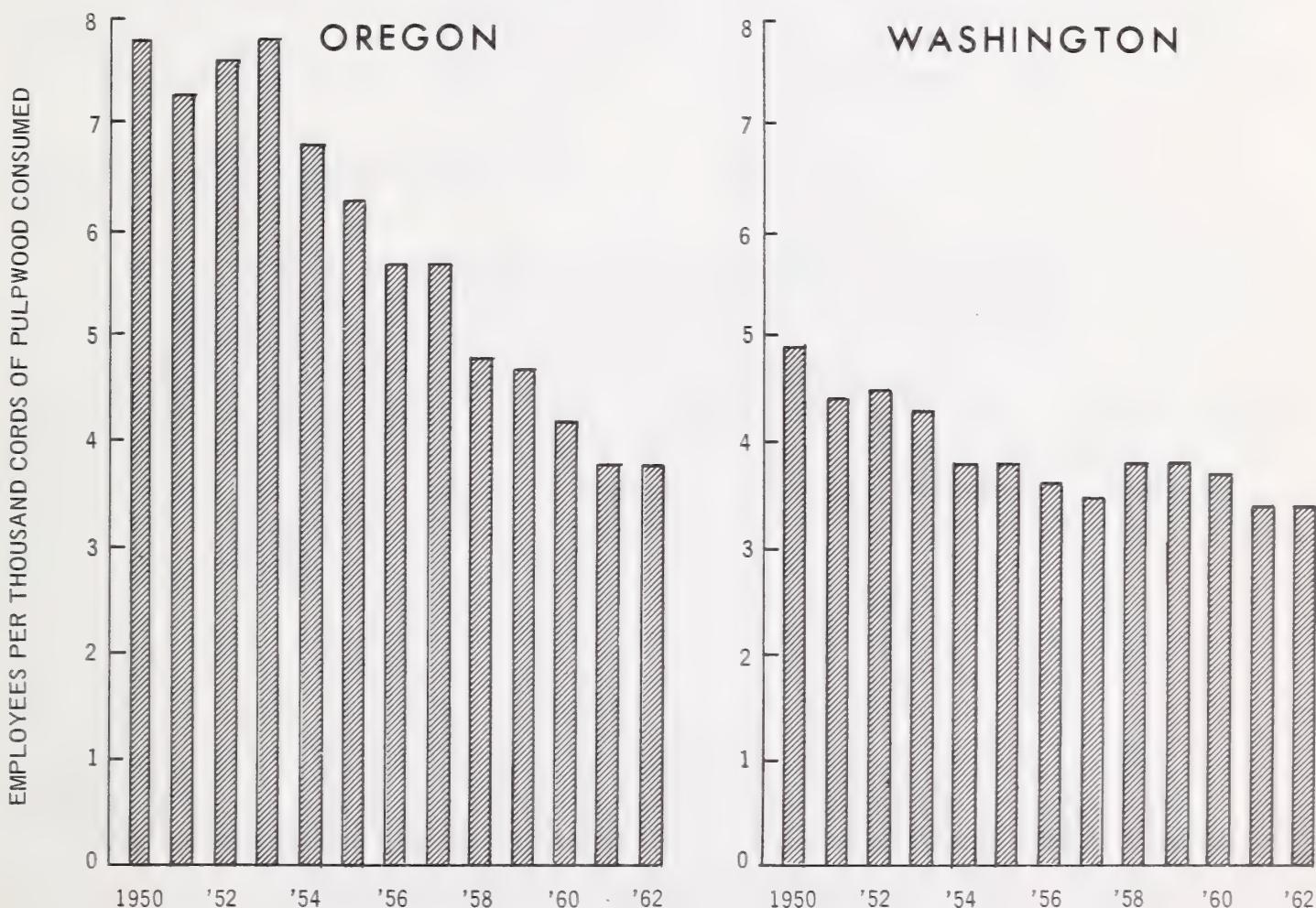


Figure 15.--Average annual employment per thousand cords of pulpwood consumed in paper and allied products in Oregon and Washington, 1950-62.

^{8/} Prepared by the Technical Committee on Industrial Classification, Office of Statistical Standards, Bureau of the Budget, Executive Office of the President. 1957.

downward trend occurred between 1950 and 1957, but since then employment has been relatively level per unit of wood consumed. During the 13-year period, employment per thousand cords decreased 1.5, from 4.9 in 1950 to 3.4 in 1962. The number of employees per thousand cords of wood consumed approached 3.5 men in both States in 1962.

Manpower Use by Job Function

Data were collected from 15 pulp and paper plants that consumed 51 percent of all the pulpwood in 1962. The following is an estimate of the average number of employees per thousand cords of pulpwood used annually for various phases of the pulp and papermaking process:

<u>Operation</u>	<u>Number of employees</u>
Pulp:	
Production workers	0.84
Other employees	<u>.23</u>
All employees	1.07
Paper and paperboard:	
Production workers	1.31
Other employees	<u>.35</u>
All employees	1.66
Converted products:	
Production workers	3.65
Other employees	<u>.97</u>
All employees	4.62
Total, all operations	7.35

Less than one production worker was used per thousand cords of wood used to make pulp. Like many chemically oriented processes, pulping is highly mechanized, and a small number of employees can produce large quantities of pulp. Paper and paperboard manufacture needed an additional 1.66 men per thousand cords. The conversion of paper into products had a high labor need of 4.62 men--70 percent more than the manpower used for pulp and papermaking combined. Thus, employment in the Pacific Northwest pulp and paper industry at a given level of paper output is markedly influenced by the degree to which paper is converted to products in plants within the region.

Fifteen paper and allied products plants provided data from which output of production workers was computed. In pulping, 741 pounds of pulp were produced per man-hour. In paper and paperboard manufacture, 490 pounds were

produced for each man-hour worked. Data on output of converted paper and board products were not available, but in terms of paper input to be converted to other paper products, average consumption of paper and board was 173 pounds per man-hour worked.

EMPLOYMENT IN OTHER WOOD-USING INDUSTRIES

Employment Shows Moderate Decline in 14 Years

Trends not well defined

Employment in other wood-using industries in Oregon and Washington decreased from 15,200 persons in 1950 to 14,300 in 1963 (figs. 2 and 16).

Although a comparison of employment at the start of the period with that of the end indicates some gains and losses, trends are not well defined. In general, it appears as if employment in this category, although somewhat variable, has stayed relatively constant.

Trends in employment in individual industries varied

In order to learn more about this composite group, the 1950-63 pattern of annual employment for individual industries within the group was determined (fig. 17). Although the record of employment is complete in Oregon, only since 1956 has Washington kept employment records by digit code, necessary for identification of each industry group. Consequently, the graphs making up figure 17 show Oregon trends from 1950 through 1955; then they are merged with those of Washington to show the common trend for two States. The only exception is the container industry where data is complete for both States over the entire time period.

Trends in employment are varied. Employment by firms that make prefabricated structures and parts shows a generally increasing trend. From 1956 through 1963, employment increased from 900 to 1,500 workers, reflecting the increasing acceptance and use of laminated-wood structural members, prefabricated wall sections, and other construction components. Another upward trend, at least in recent years, occurred in the special-product sawmills, which make alder furniture stock, cedar shingles, and small quantities of miscellaneous items. They are located in western Oregon and western Washington, with about three-quarters of the employment in Washington. Employment in this group increased from 2,600 in 1956 to 3,200 in 1963; much of this increase is attributed to an increased output of both furniture stock and cedar shingles.

A similar rise in employment has also occurred in the "miscellaneous" industry classification, with employment in recent years increasing from 1,300 in 1956 to almost 1,600 in 1963. Apparently the principal reason for this increased employment is the growth of the particle board industry which is included in this category.

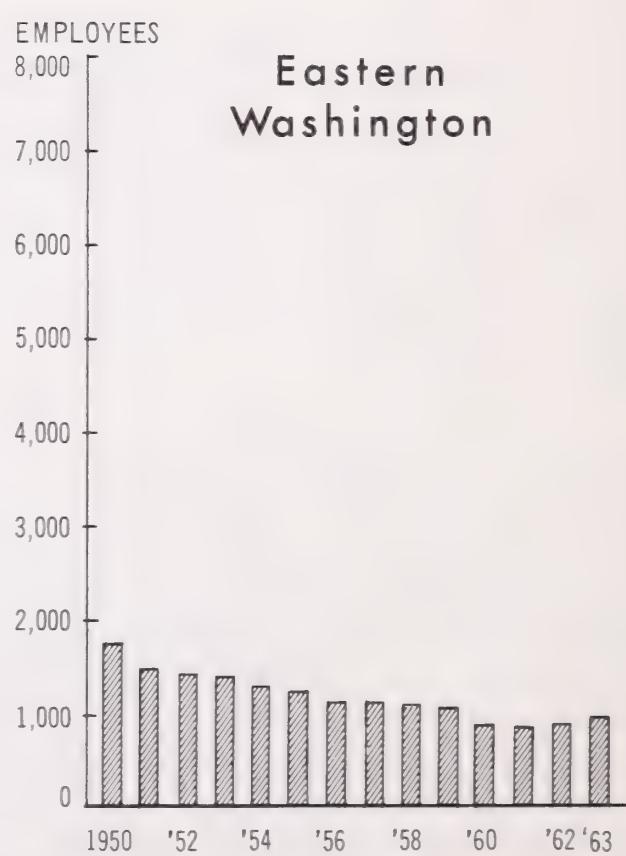
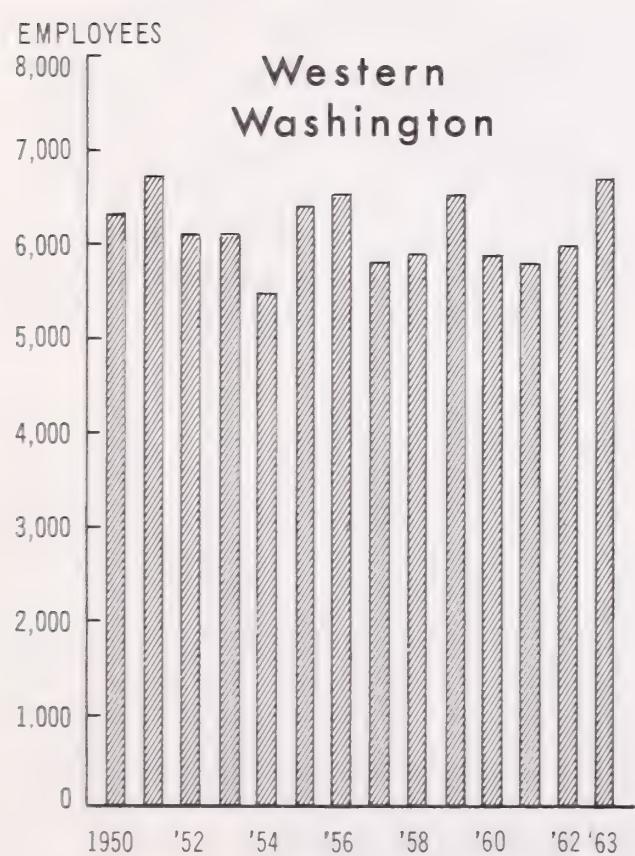
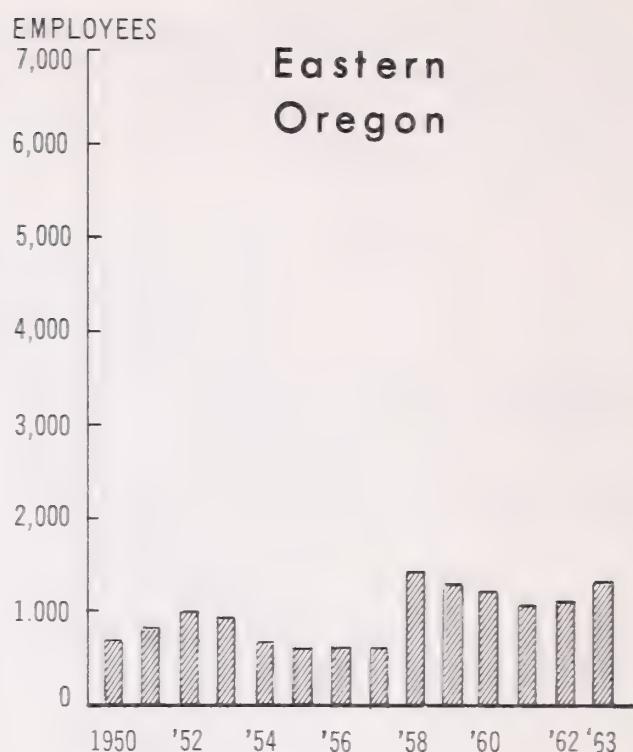
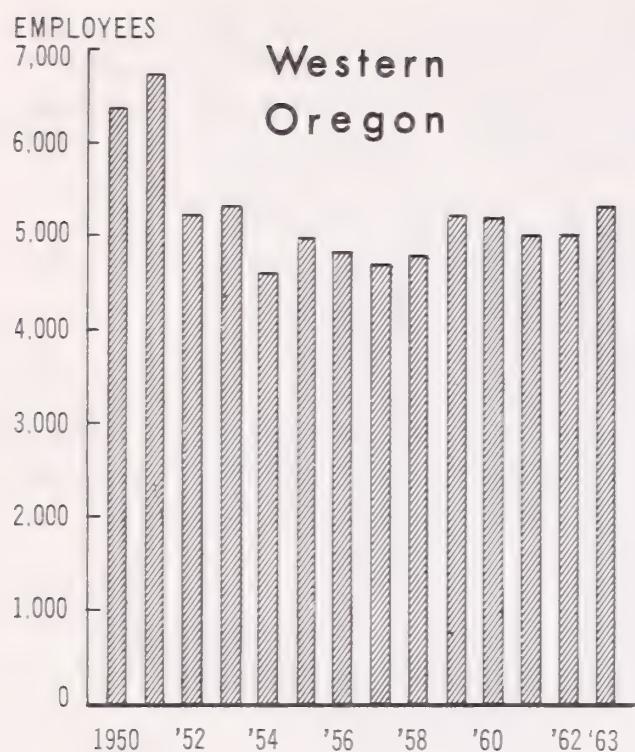


Figure 16.--Average annual employment in all other wood manufacturing in Oregon and Washington, by State subregion, 1950-63.

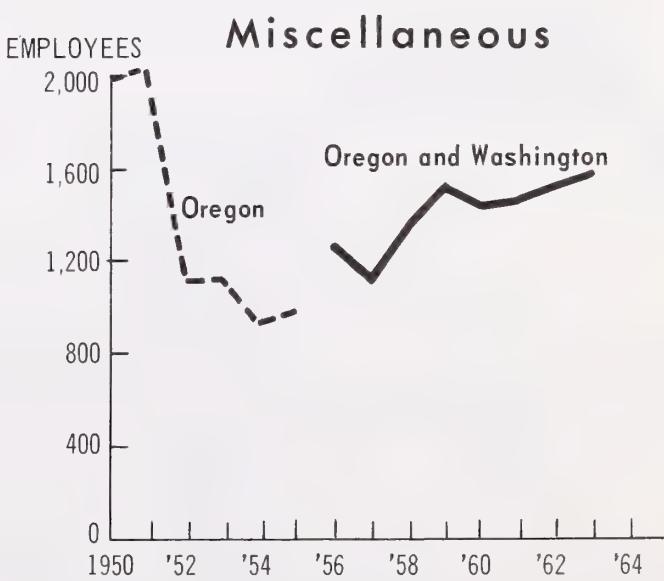
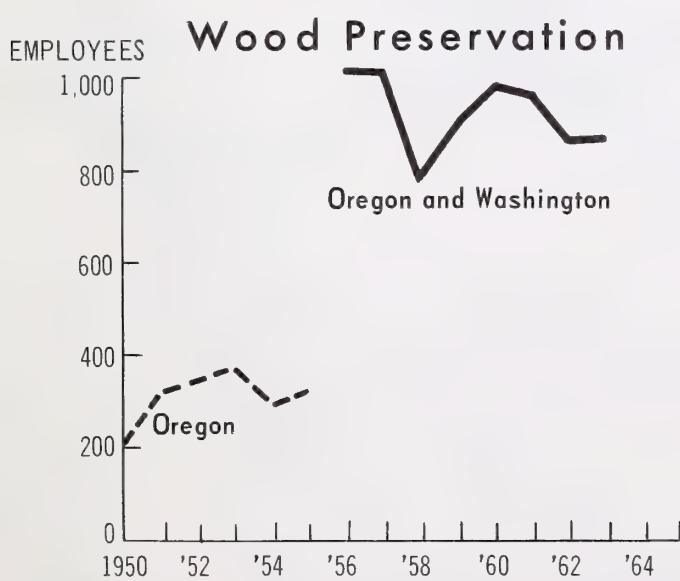
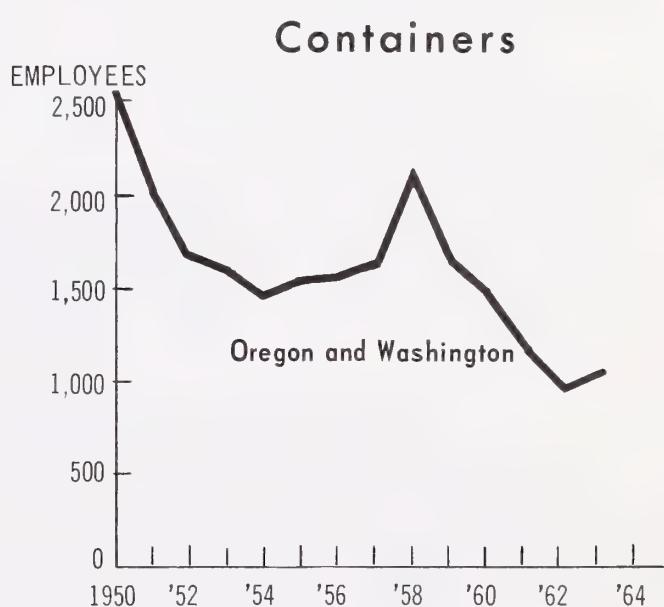
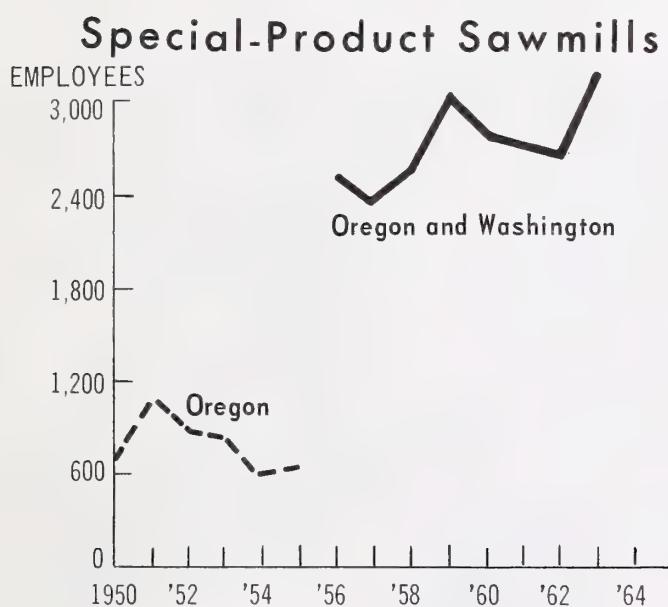
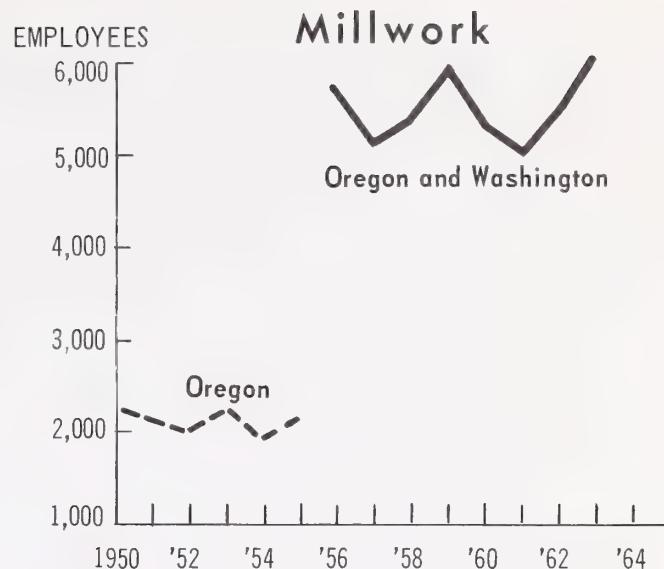
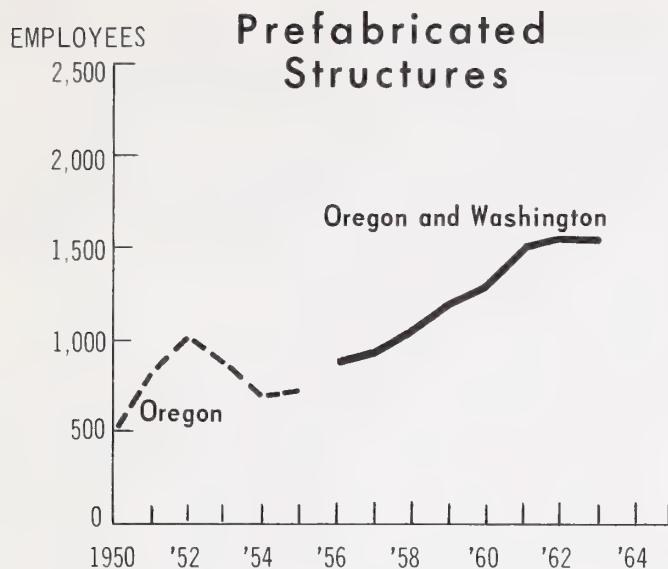


Figure 17.--Employment in component industries within all other wood-manufacturing groups in Oregon and in Washington, 1950-63.

Although 1963 employment in millwork reached a new high for the industry, past trends indicate an erratic pattern with no apparent long-term trend of either decreasing or increasing employment.

The continuous record of employment for the wood container industry indicates a gradual downward trend, from 2,600 in 1950 to 1,000 in 1963, due to competition from paperboard boxes and other containers. The large upswing in numbers of employees in 1958 may have been caused by several factors, but it is most likely associated with the reclassification of industries following revision of the Standard Industrial Classification in 1957. Employment in the wood preservation industry indicates a rather static situation without strongly observable trends. Employment between 1950 and 1956 in Oregon was about 300; the inclusion of Washington employment data in 1956 raised the total to about 1,000. Since 1956, the trend has been gradually downward, with 1963 employment being 870.

Man-use per unit of production for the "other" products industries was not determined because of the difficulty of obtaining adequate records of volume of output.

AVERAGE MONTHLY EMPLOYMENT IN OREGON

AND WASHINGTON, 1957-61

Variation in Total Employment

Previously in this study, employment in the forest industries was reported as average annual number of workers. Employment in all forest industries fluctuates, more or less, during the year. For example, the seasonal nature of employment in logging is well known.

During the period 1948-53, employment in Oregon and Washington in lumber and other wood products combined varied from 15 percent below average employment to 10 percent above.^{9/} Seasonal variation in total employment in both States was substantially less, but was greater than that for total employment in the United States.

Statistics of employment by month in forest-based industries were analyzed for the period 1957-61 to determine monthly variation in employment as a percentage of average monthly employment during the 5-year period. All industry groups showed a somewhat similar seasonal pattern of employment, generally lowest during January, February, and March, and highest during

^{9/} Mead, W. J. The forest products economy of the Pacific Northwest. Jour. Land Econ. 32(2): 127-133. May 1956.

July, August, and September. With the exception of converted paper products and preserved wood, most wood products are further processed by other manufacturers, used in commerce, or used in construction. Requirements for wood products fluctuate with the activity of these industrial purchasers. Thus, employment in the forest industries is strongly influenced by activity in other industries and trade.

Industries Differ Widely in Amount of Variation

Seasonal fluctuation large in logging industry

Logging employment varies substantially from summer to winter (fig. 18). In the monthly averages for the years 1957-61, August was the peak month in western Oregon, 22 percent above average monthly employment; but in western Washington, employment peaked earlier, reaching a high of 17 percent in June. Employment in both western Oregon and western Washington dropped to near average by November and reached a low point during January and February. Increased logging activity in the spring resulted in a return to average monthly employment by the end of April. In eastern Oregon and eastern Washington, seasonal fluctuation is more severe. In eastern Oregon, the range was from 24 percent above normal during August and September to 48 percent below in

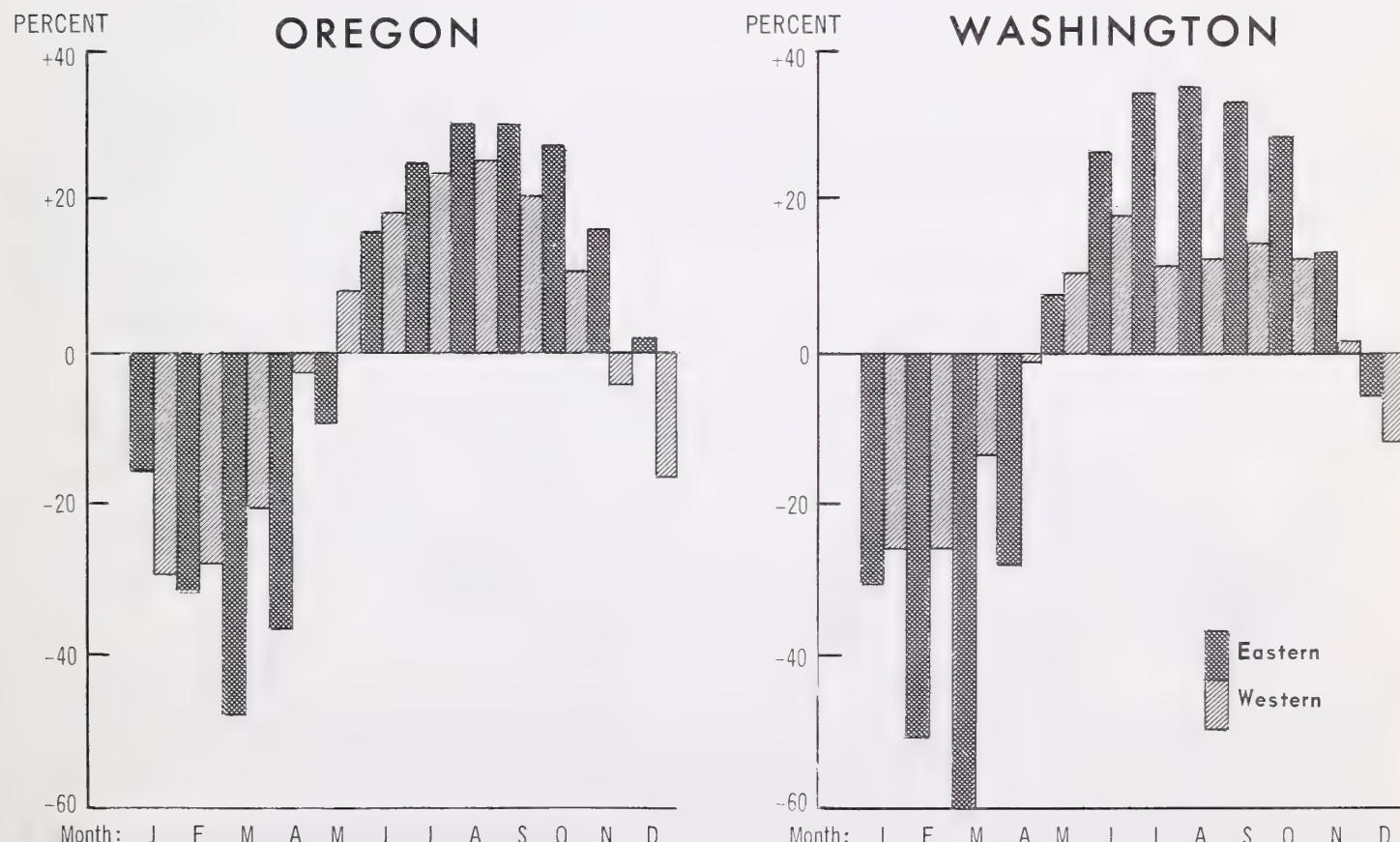


Figure 18.--Monthly deviations (in percent) from average logging employment during 1957-61 in Oregon and Washington, by State subregion.

March; in eastern Washington, the extremes were even greater, ranging from 35 percent above normal to 60 percent below. Logging activity apparently is more strongly influenced by unfavorable winter weather east of the Cascade Range. Logging employment showed a decidedly uniform cycle from summer to winter each year during the 5-year period.

Range of monthly sawmill employment \pm 8 percent

Employment in sawmills and planing mills (excluding special products sawmills) shows less variation with almost identical seasonal patterns in Oregon and Washington. During the study period, the range in Oregon was from 8 percent above average in August to 8 percent below in January and February (fig. 19). In Washington these same months marked a 6 percent high and a 7 percent low in monthly employment. No differences were apparent between mills in eastern and western Oregon, but in eastern Washington the range in monthly employment was much larger from summer to winter than in western Washington.

The seasonal pattern of sawmill and planing mill employment is generally similar to that for logging. Lumber manufacturing is influenced both by log supply and seasonal requirements for lumber and other mill products. The Nation's construction industry, the largest consumer of lumber, is most active during summer months.

Less seasonal variation in plywood and paper industries

Employment in veneer and plywood plants shows the least variation in employment from month to month (fig. 20). Employment in the 5-year period

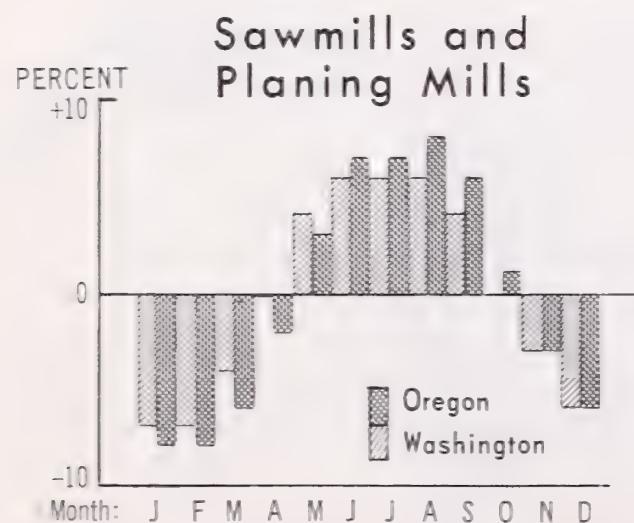


Figure 19.--Monthly deviations (in percent) from average employment during 1957-61 in sawmills and planing mills in Oregon and Washington.

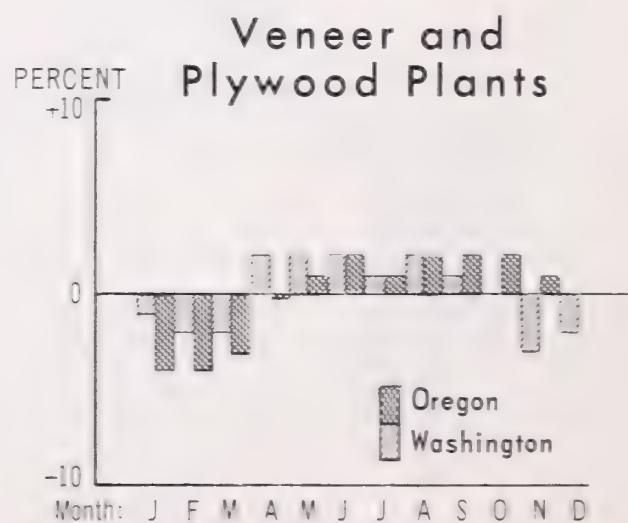


Figure 20.--Monthly deviations (in percent) from average employment during 1957-61 in veneer and plywood plants in Oregon and Washington.

ranged up to 2 percent above the annual average for 7 months of the year and dropped to only slightly less than average--3 percent in Oregon and 4 percent in Washington--during the off-season months. No regular cycle of monthly employment was apparent from year to year, although Oregon employment was highest in June in 4 out of 5 years.

Firms primarily engaged in making pulp, paper, and paperboard in Oregon experienced stability in employment comparable to that of the plywood industry (fig. 21). Employment varied from 4 percent above average in July to 2 or 3 percent below average from October through March. Peak summer months of employment were experienced each year.

Employment in building-paper mills in Oregon varied slightly more from summer to winter months (fig. 21), but regular yearly cycles were less evident. Only 1958 and 1961 showed pronounced gains in summer employment. Oregon paperboard container manufacturers experienced minor variation in employment from 4 to 5 percent above average in the summer to 3 to 6 percent below average employment from December through May. Each year had a uniform cycle which peaked in July and dropped to a low in January.

A similar analysis of the paper industries was not made for Washington. However, the nature of the industry would indicate relations generally comparable to those in Oregon.

Other industries show similar seasonal pattern but varying amount

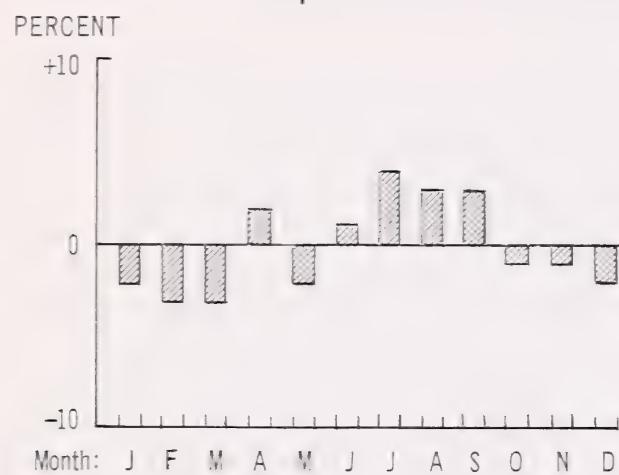
Millwork employment was fairly stable, from 6 percent above average to 6 percent below average monthly employment (fig. 22). Here, as for the remaining "other" industries, the relatively small size of each industry group made it desirable to report variation in monthly employment for Oregon and Washington combined.

Employment in prefabricated structures and parts varied by 30 percent between August and February. This industry makes products on prior order, and it depends on seasonal construction activity. Millwork firms also supply the construction industry but rely less on custom work.

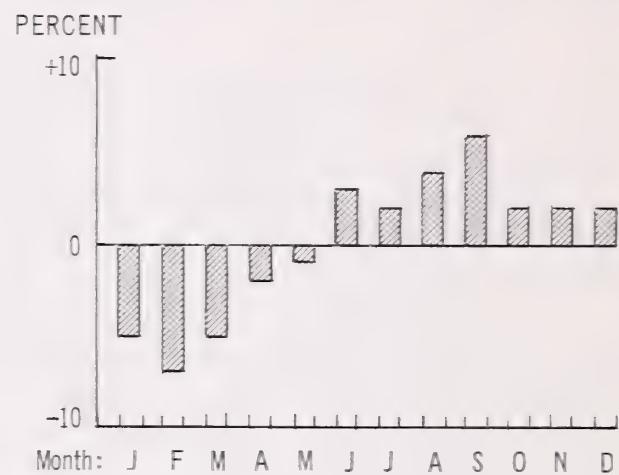
Wooden container manufacture was also highly seasonal, ranging from a high of 18 percent above average in July and August to a low of 16 percent below average in February. This was repeated in uniform cycles during the 5-year period.

Special product sawmills, primarily producers of alder furniture stock and wood shingles and shakes, exhibited a pattern of employment similar to general sawmills and planing mills during peak periods of employment. However, during the off-season period from January through March, employment in special product sawmills decreased more than in general sawmills.

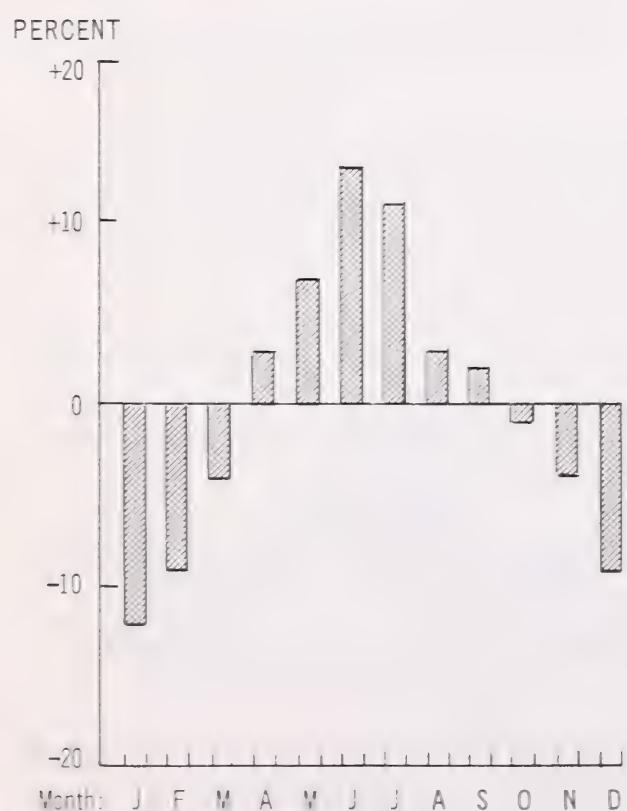
Pulp, Paper and Paperboard



Building Paper



Other Converted Products



Paperboard Containers

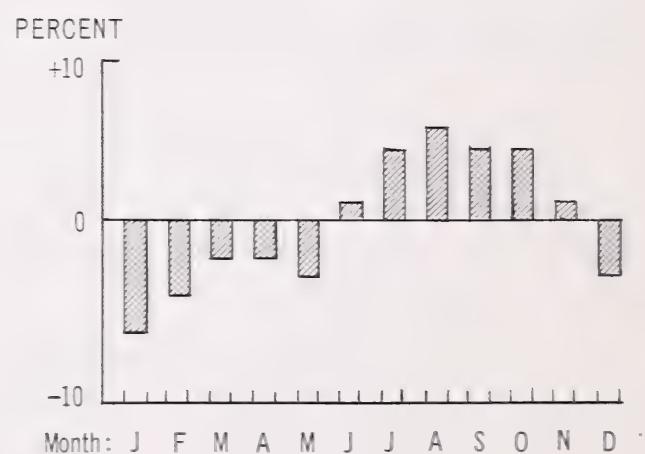
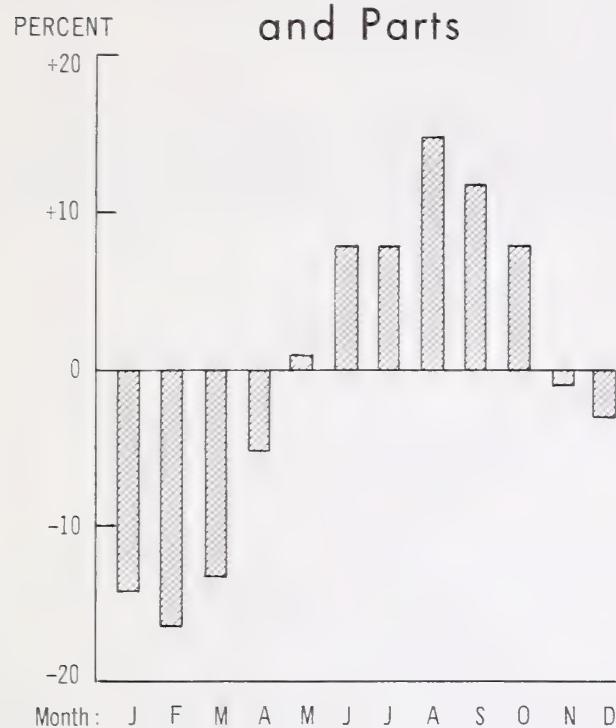
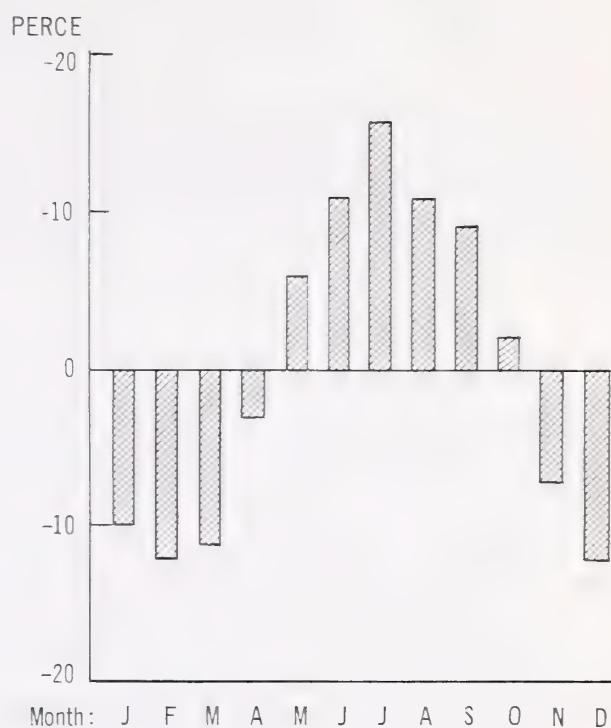


Figure 21.--Monthly deviations (in percent) from average employment during 1957-61 in pulp, paper, and allied products in Oregon.

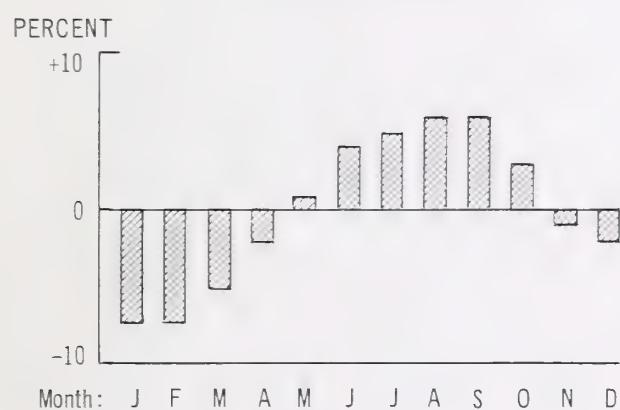
Prefabricated Structures and Parts



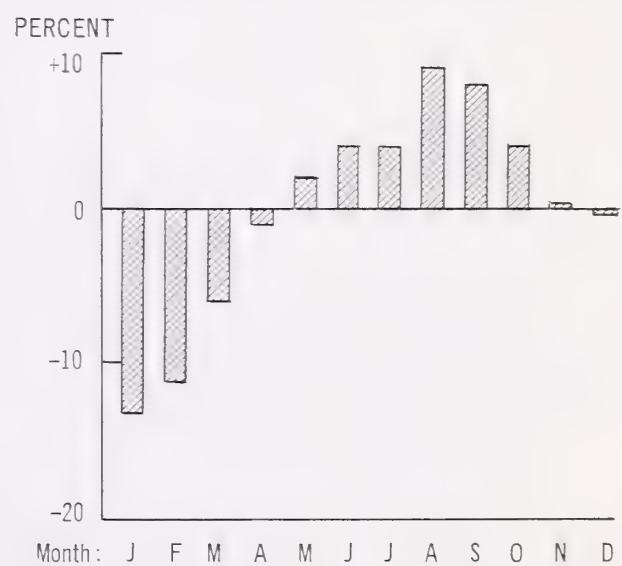
Wooden Containers



Millwork



Special-Product Sawmills



Wood Preservation

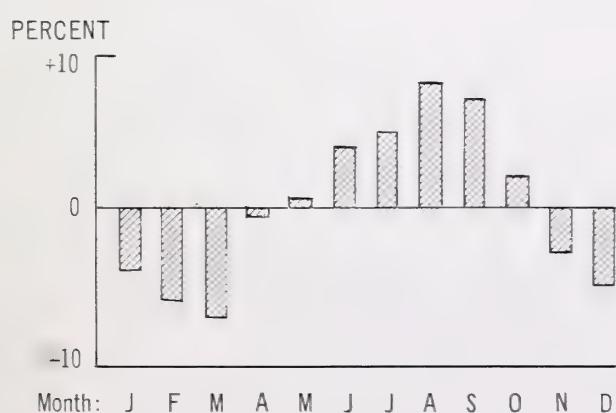


Figure 22--Monthly deviations (in percent) from average employment during 1957-61 in other wood manufacturing in Oregon and Washington combined.

Employment in wood preservation, though cyclic from summer to winter, varied only 7 percent above and 8 percent below average employment.

Thus, with the exception of logging, prefabricated structures, wooden containers, and special product sawmills, employment in the wood-products industries, though exhibiting seasonal fluctuation, varied less than 10 percent from the annual average number of workers.

APPENDIX

Definition of Industries

Industries studied are included in "Major Group 24, Lumber and Wood Products, Except Furniture" and "Major Group 26, Paper and Allied Products," described in the "Standard Industrial Classification Manual." The major industries are:

Logging

Industry No. 2411. Logging camps and logging contractors.-- Logging camps and logging contractors primarily engaged in cutting timber and in producing rough, round, hewn, or riven primary forest or wood raw materials. Independent contractors engaged in estimating or trucking timber, but who perform no cutting operations are classified in non-manufacturing industries. Logging and woods operations conducted in combination with sawmills, pulp mills, or other converting establishments, and not separately reported, are classified in their respective industry groups; namely, with sawmills in Group 242, veneer and plywood mills in Group 243, pulp mills in Major Group 26, and charcoal and wood distillation plants in Group 286. Establishments primarily engaged in the collection of bark, sap, gum, and other forest byproducts are classified in nonmanufacturing industries.

Sawmills and Planing Mills

Industry No. 2421. Sawmills and planing mills, general.-- Establishments primarily engaged in sawing rough lumber and timber from logs and bolts, or re-sawing cants and flitches into lumber, including box lumber and softwood cut stock; planing mills combined with sawmills; and separately operated planing mills which are engaged primarily in producing surfaced lumber and standard workings or patterns of lumber. This industry includes establishments primarily engaged in sawing lath and railroad ties, and in producing tobacco hogshead stock and snow fence lath. Establishments primarily engaged in manufacturing box shook or boxes are classified in Group 244; and sash, doors, wood molding, window and door frames, and other fabricated millwork in Industry 2431; and hardwood dimension and flooring in Industry 2426. Logging camps combined with sawmills, when not separately reported, are included in this Industry.

Veneer and Plywood Plants

Industry No. 2432. Veneer and plywood plants.-- Establishments primarily engaged in producing commercial veneer, either face or technical, and those primarily engaged in manufacturing commercial plywood, including nonwood backed or faced veneer and nonwood faced plywood, from veneer produced in the same establishment or from purchased veneer.

Establishments primarily engaged in the production of veneer which is used in the same establishment for the manufacture of end products such as fruit and vegetable baskets are classified in Industry 2443, and wood boxes in Industries 2441 and 2442.

Other Wood Manufacturing

Industry No. 2426. Hardwood dimension and flooring mills.--Establishments primarily engaged in manufacturing hardwood dimension lumber and workings therefrom; and other hardwood dimension, semifabricated or ready for assembly; and hardwood flooring. Establishments primarily engaged in manufacturing stairwork, molding, and trim are classified in Industry 2431; and those manufacturing textile machinery bobbins, picker sticks and shuttles in Industry 3552.

Industry No. 2429. Special product sawmills, not elsewhere classified.--Mills primarily engaged in manufacturing excelsior, wood shingles, and cooperage stock, and in sawing special products, not elsewhere classified.

Industry No. 2431. Millwork plants.--Establishments primarily engaged in manufacturing fabricated millwork. Planing mills primarily engaged in producing millwork are included in this industry, but planing mills primarily producing standard workings or patterns of lumber are classified in Industry 2421.

Industry No. 2433. Prefabricated wooden buildings and structural members.-- Establishments primarily engaged in manufacturing prefabricated wooden buildings, sections, and panels; or in producing laminated or fabricated trusses, arches, and other structural members of lumber. Prefabrication on the site of construction is not included in this industry.

Industry No. 2441. Nailed and lock corner wooden boxes and shook.--Establishments primarily engaged in manufacturing nailed and lock corner wooden boxes, and which also may produce shook for nailed and lock corner boxes.

Industry No. 2442. Wirebound boxes and crates.--Establishments primarily engaged in manufacturing wirebound boxes and crates.

Industry No. 2443. Veneer and plywood containers, except boxes and crates.--Establishments primarily engaged in manufacturing veneer and plywood containers, except boxes. This industry includes baskets made primarily of veneer and splint for shipping and marketing fruits and vegetables.

Industry No. 2445. Cooperage.--Establishments primarily engaged in manufacturing barrels, tubs, hogsheads, and other containers made of staves, except fruit and vegetable baskets (Industry 2443). Establishments primarily engaged in manufacturing tobacco hogshead stock are classified in Industry 2421, and those manufacturing cooperage stock in Industry 2429.

Industry No. 2491. Wood preserving.--Establishments primarily engaged in treating wood, sawed or planed in other establishments, with creosote or other preservatives to prevent decay and to protect against fire and insects. This industry also includes the cutting, treating, and selling of poles, posts, and piling, but establishments primarily engaged in manufacturing other wood products, which they may also treat with preservatives, are not included.

Industry No. 2499. Wood products, not elsewhere classified.--Establishments primarily engaged in turning and shaping wood, and manufacturing miscellaneous wood products, not elsewhere classified such as lasts and related products, cork products, mirror and picture frames, and particle board.

Pulp

Industry No. 2611. Pulp mills.--Establishments primarily engaged in manufacturing pulp from wood or from other materials such as rags, linters, waste paper, and straw. Logging camps operated by pulp mills, and not separately reported, are also included in this industry. Establishments primarily engaged in cutting pulpwood are classified in Industry 2411; and pulp mills combined with paper mills or paperboard mills, and not separately reported, are classified with the latter in Industries 2621 and 2631, respectively.

Paper, Paperboard, Building Paper and Board

Industry No. 2621. Paper mills, except building paper mills.--Establishments primarily engaged in manufacturing paper (except building paper-Industry 2661) from wood pulp and other fibers, and which may also manufacture converted paper products. Pulp mills combined with paper mills, and not separately reported, are also included in this industry; where separately reported, they are classified in Industry 2611. Establishments primarily engaged in manufacturing converted paper products from purchased paper stock are classified in Group 264 or 265.

Industry No. 2631. Paperboard mills.--Establishments primarily engaged in manufacturing paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fibers; and which may also manufacture converted paperboard products. Pulp mills combined with paperboard mills, and not separately reported, are also included in this industry; where separately reported, they are classified in Industry 2611. Establishments primarily engaged in manufacturing converted paperboard products from purchased paperboard are classified in Group 264 or 265.

Industry No. 2661. Building paper and building board mills.--Establishments primarily engaged in manufacturing building paper and building board from wood pulp and other fibrous materials. Pulp mills combined

with building paper and building board mills, and not separately reported, are also included in this industry; where separately reported, they are classified in Industry 2611.

Paperboard Containers and Boxes

Industry No. 2651. Folding paperboard boxes.--Establishments primarily engaged in manufacturing folding paperboard boxes from purchased paperboard.

Industry No. 2652. Set-up paperboard boxes.--Establishments primarily engaged in manufacturing set-up paperboard boxes from purchased paperboard.

Industry No. 2653. Corrugated and solid fiber boxes.--Establishments primarily engaged in manufacturing corrugated and solid fiber boxes and related products from purchased paperboard or fiber stock. Important products of this industry include corrugated and solid fiberboard boxes, pads, partitions, display items, pallets, single face products, and corrugated sheets.

Industry No. 2654. Sanitary food containers. Establishments primarily engaged in manufacturing food containers from special food board. Important products of this industry include fluid milk containers; folding paraffined cartons for butter, margarine, and shortening; ice cream containers; frozen food containers; liquid tight containers; round nested food containers; paper cups for hot or cold drinks; and pails for food and ice cream.

Industry No. 2655. Fiber cans, tubes, drums, and similar products.--Establishments primarily engaged in manufacturing fiber cans, cones, drums, and similar products with or without metal ends, from purchased materials; and vulcanized fiber boxes.

Other Paper and Board Products

Industry No. 2641. Paper coating and glazing.--Establishments primarily engaged in manufacturing coated, glazed, or varnished paper from purchased paper. Establishments primarily engaged in coating paper on the paper machine are classified in Industry 2621; those manufacturing carbon paper in Industry 3955, and photographic and blueprint paper in Industry 3861.

Industry No. 2642. Envelopes.--Establishments primarily engaged in manufacturing envelopes of any description from purchased paper and paperboard. Establishments primarily engaged in manufacturing paper-teries (boxed stationery) are classified in Industry 2649.

Industry No. 2643. Bags, except textile bags.--Establishment primarily engaged in manufacturing bags from purchased paper, cellophane, acetate, polyethylene, pliofilm, foil, and similar sheet or film materials.

Industry No. 2644. Wallpaper.--Establishments primarily engaged in designing, printing, and embossing paper for interior walls, and ceilings. The paper stock used by this industry is called "hanging paper" and is produced by paper mills classified in Industry 2621.

Industry No. 2645. Die cut paper and paperboard; and cardboard.--Establishments primarily engaged in die cutting purchased paper and paperboard, and in manufacturing cardboard by laminating, lining, or surface coating paperboard. Establishments primarily engaged in laminating building paper or building board from purchased paper or board are classified in Industry 2649.

Industry No. 2646. Pressed and molded pulp goods.--Establishments primarily engaged in manufacturing all kinds of pressed and molded pulp goods, including papier-mache¹ articles other than statuary and art goods (Industry 3299). Establishments primarily engaged in manufacturing plates and utensils from paper are classified in Industry 2654.

Industry No. 2649. Converted paper and paperboard products, not elsewhere classified.--Establishments primarily engaged in manufacturing from purchased paper or paperboard miscellaneous converted paper or paperboard products, not elsewhere classified.

Other wood manufacturing

Several SIC divisions within Major Group 24 were combined as miscellaneous wood manufacturing when employment was reported. The group includes hardwood dimension mills, shingle mills, millwork plants, prefabricated structures, wooden containers, and wood preserving. Industries in this group are either secondary manufacturers or they process a small amount of the total log harvest. They employ a relatively small proportion of the total number of workers. Manpower requirements of these industries were not studied because of the difficulty in determining quantity of wood processed, the many different processes involved, and the lack of a satisfactory common unit of volume measurement.

Paper and allied products

Establishments primarily engaged in the manufacture of pulps from wood and other cellulose fibers and rags; the manufacture of paper and paperboard; and the manufacture of paper and paperboard into converted products such as paper coated off the paper machine, paper bags, paper boxes, and envelopes. Employment was reported for industries within the paper and allied products group.

Wood is consumed by firms in Major Group 25, Furniture and Fixtures, but these industries were not studied because the quantities of wood processed, often in combination with other materials, and numbers of workers employed in the Pacific Northwest are small.

Compilation of Employment Statistics

Employment in the forest industries for the period 1950 to 1963 was compiled as the annual average number of employees. Data furnished by the Oregon Department of Employment and Washington Employment Security Department were based on reports of average monthly employment and payrolls submitted by employers whose workers are entitled to benefits provided by State unemployment laws. The method of reporting, based on the payroll period which ends closest to the 15th of the month, may obscure fluctuations resulting from employment of part-time workers. Part-time employment chiefly affects the number of employees reported by small logging contractors. Employment in all wood-using industries is subject to more or less seasonal fluctuation. The use of annual averages tends to level seasonal fluctuation to the equivalent number of full-time workers employed during the year.

Employment statistics include all employees of a firm: production workers, maintenance and other plant workers, clerical, supervisory overhead, technical and staff workers, and company officials, but they do not include owners. The practice of reporting all employees in the main business of the firm distorts some of the classifications. A sawmill operator's report may combine both a logging crew and millworkers. The number of workers is classified under "2421, Sawmills and planing mills, general," because lumber manufacture is the main business of the firm. Similarly, employees of a pulp and paper manufacturer, including both workers in the pulpmill and those in the papermill, may be classified under "2621, Papermills, except building paper mills." Such combinations occur chiefly in the reports of small firms where the number of employees is few. Whenever possible, State agencies obtain separate reports of employment where more than one classification of workers is employed by a firm. The effect of such combinations, as used in this study, is minor. The Standard Industrial Classification was revised in 1957. Changes in the timber industries were accounted for or they did not materially affect classification in the industries as grouped for study.

In Washington, all employees in the manufacturing sector, regardless of size of firm or amount of payroll, have been covered by employment security legislation since before 1950. In Oregon, from 1950 to 1955, firms with less than four employees were not required to report, and from 1956 to 1959, firms with one employee did not report. No adjustments were made in the reported figures for lumber and wood-products employment, as firms employing less than four persons prior to 1956 or less than two prior to 1960 are not significant

in the employment picture for this classification.^{10/} Since 1960, coverage has been complete in the manufacturing sector.

Statistics on Volume of Wood Used by Forest Industries

Volume of logs harvested was taken from annual reports of log production, issued by the Forest Survey, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. This was converted from the reported Scribner log volume to International 1/4-inch volume by use of a factor of 1.25 on the west side and 1.10 on the east side of the Cascade Range.

Volume of logs used by sawmills was based on reports of annual lumber production by State, issued by the Bureau of the Census, U.S. Department of Commerce: "Facts for Industry," Series M24T (formerly M13G), and "Current Industrial Reports," Series M24T. Log volumes, when in terms of the International 1/4-inch rule, were considered the equivalent of lumber production. Lumber production was allocated to State subregion according to the percentage of total lumber production reported for the west side by the West Coast Lumbermen's Association Statistical Yearbook, 1959-62, and for the east side by Circular 483 of the former Western Pine Association.

Volume of logs consumed in making veneer and plywood in Oregon was obtained from the Bureau of the Census "Facts for Industry," Series M24H (formerly Series M13B), and, in recent years, from "Current Industrial Reports," Series M24H. Census data were not used for Washington as they include Idaho and Montana production. Instead, production data for Washington were from American Plywood Association. Production data were converted to Scribner log scale on the basis of an output of 2.4 square feet, 3/8-inch rough, per board foot of log consumed. Scribner volumes for logs were converted to International 1/4-inch volume as reported above.

Statistics of pulpwood consumption, contained in Bureau of the Census "Facts for Industry," Series M14A, and "Current Industrial Reports," Series M26A, were adjusted, using data from several sources. Adjustment was necessary to account for data withheld to prevent disclosure of information concerning individual firms and inclusion of pulpwood consumption for areas other than Oregon and Washington.

^{10/} Trends of Employment in Oregon, 1950-1960. p. 111. Prepared for the Bonneville Power Administration by the Bureau of Business Research, University of Oregon, February 1962.

Trends in Output Per Man-Hour

The results of increasing labor efficiency, substitution of machines for hand labor, improved plant layout, organization of the labor force, and product specifications can be expressed as increased output per man-hour or as decreased manpower use per unit of wood input. Since the source of data or number of employees cannot be used to accurately determine number of hours worked and since number of employees includes nonproduction workers, other sources are needed to get measures of output per man-hour. The Western Wood Products Association (formerly, West Coast Lumbermen's Association and Western Pine Association) and the American Plywood Association (formerly, Douglas Fir Plywood Association) have the necessary data from mills reporting directly to them for the lumber and plywood industry. Similar data are not available for the pulp and paper industry. The association data for manpower use differ from those previously shown because they include production workers only. According to the Census of Manufactures in 1958, the proportion of production workers to all employees in the Pacific Northwest was:

<u>Industry</u>	<u>Percent</u>
Logging	89
Sawmills and planing mills	90
Veneer and plywood	92

Thus, output per man-hour, based on association data, is approximately 10 percent higher than if the ratios were based on all employees.

Smith, Richard C., and Gedney, Donald R.
1965. Manpower use in the wood-products industries
of Oregon and Washington 1950-1963. U.S.
Forest Serv. Res. Paper PNW-28, 48 pp., illus.
Pacific Northwest Forest & Range Experiment
Station, Portland, Oreg.

An analysis of manpower use in the wood-using in-
dustries of Oregon and Washington, during the period
1950 through 1963, showed an increase in production but
a decrease in overall employment. Data show employment
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